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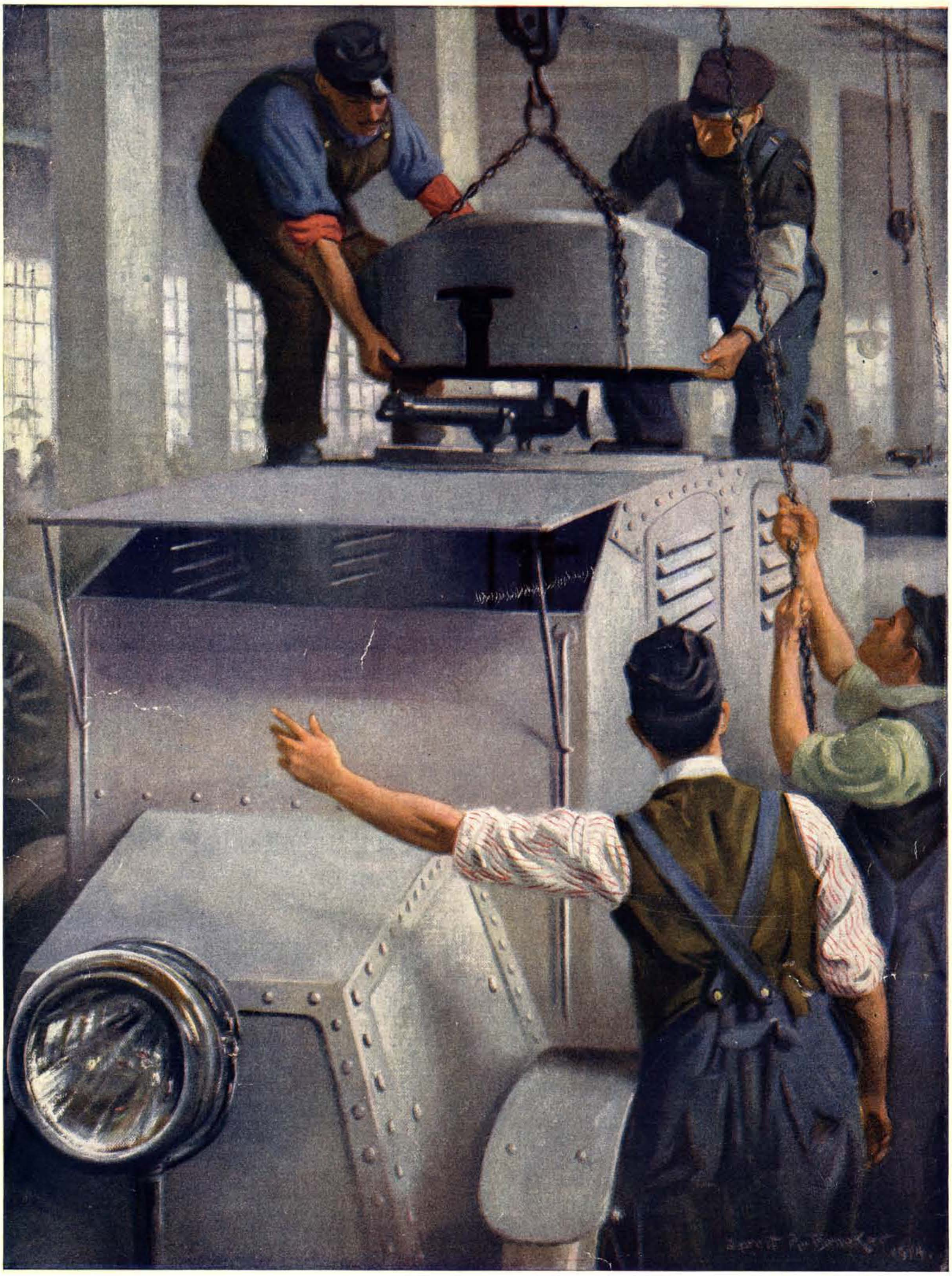

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THE WHITE
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The distinguishing characteristic of a masterpiece is harmonious perfection
Every line in the marble, every color in the picture, every thought in the book, belongs to and blends into the complete creation.
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Something New—Strikingly Distinctive
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FOR the first time in the history of tire making appearance has been given its rightful share of attention. The result is the Fisk "Red Top"—the wonderfully attractive tire with the white sidewall and pleasing red non-skid tread—which adds the note of completeness to the finely appointed limousine or lends distinction to the most modest car.
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Time to Re-tire? (Buy Fisk)
Finality in Tire Equipment

Standard of the World

All argument ends with your first ride in

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The new Cadillac with its V-type Eight-Cylinder Engine is proving an absorbing topic for engineers and experts as well as for the layman.

Technical arguments, vague and beclouded, can of course be advanced for and against any and every type of engine ever produced.

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He has only to consult his own feelings and sensations.

He recognizes the difference just as clearly as he would recognize the difference, for instance, between riding over the ground and riding in the air.

And compared with previous motor car experiences, riding in the Cadillac is very much like riding in the air.

It is not necessary to point out to him that the Cadillac Eight-Cylinder engine exhibits a new degree of flexibility.

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He does not need to be told that the car is surpassingly smooth.

He ***feels*** it—precisely as he feels that hills seem to flatten out before this wonderful car.

The engineer can explain to the layman the why and the wherefore of these differences; but the layman can feel just as keenly as can the engineer, that a ride in this car is not like any ride either of them has ever taken.

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But Cadillac owners have a pleasant habit of expressing complete confidence in Cadillac promises.

They are chiefly concerned to know ***how much*** and ***how far*** the Eight-Cylinder Cadillac will surpass all that has been said of it in our announcements.

And they have demonstrated the faith that is in them by placing advance orders to an extent which far surpasses all previous records.

That fine spirit of expectation will not be disappointed.

We repeat—for expert and layman, all theorizing will end with the first ride in the Eight-Cylinder Cadillac.

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Standard Seven passenger car, Five passenger car and Five passenger Salon, $1975. Roadster, $1975
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SEVENTY-FIRST YEAR

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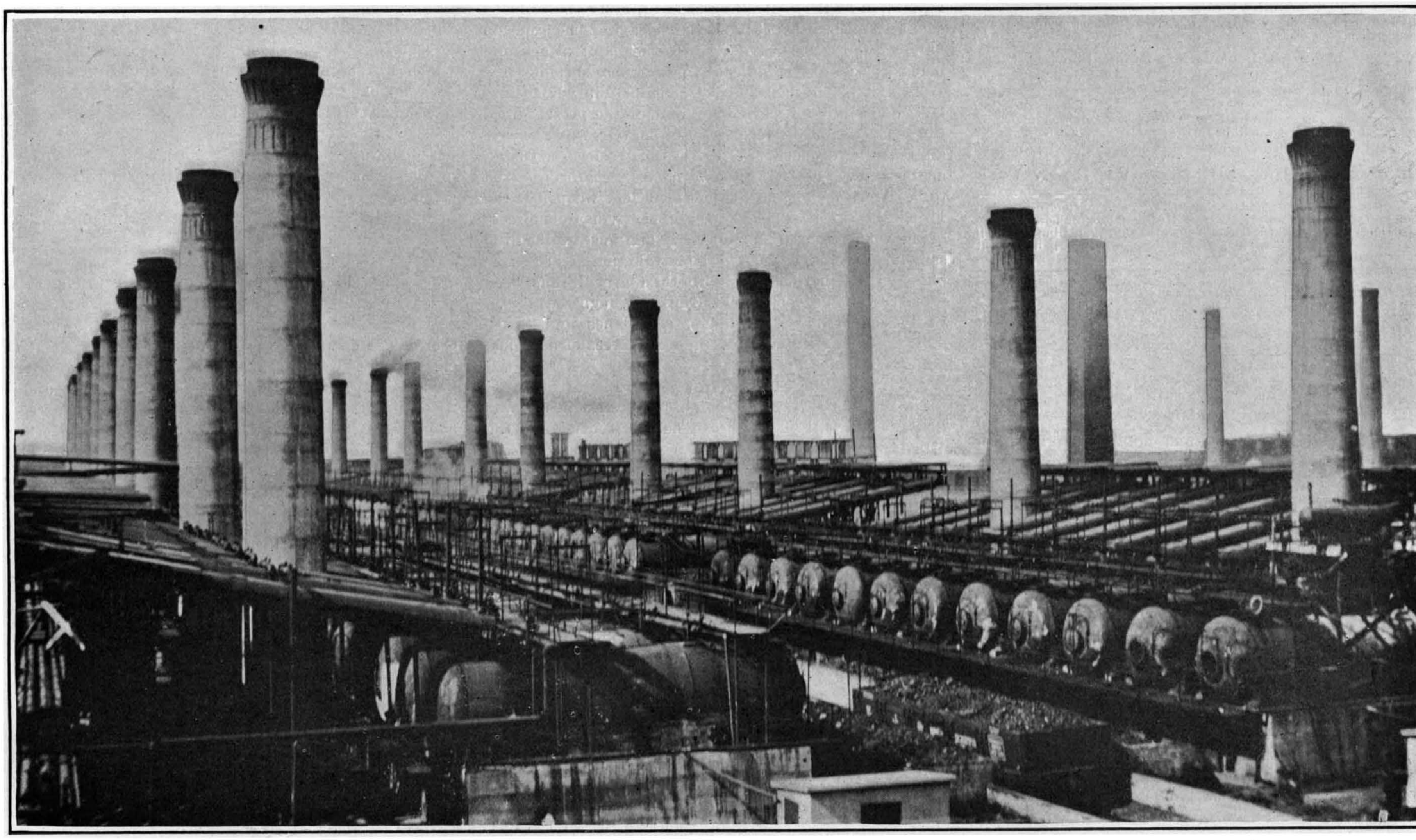

Plant for producing gasoline by the Burton process of distillation under pressure.

The Burton Process of "Cracking" to Make Gasoline

By C. H. Claudy

GASOLINE, not long ago a by-product of petroleum refining, has come to be one of the most important results of crude oil distillation. The rise of the internal combustion engine, and its rapid perfecting, due to the enormous increase in the manufacture of the automobile, has not only created a tremendous demand for gasoline for the motorcar, but has spread the doctrine of cheap and easily secured power throughout the world, so that motorboats, aeroplanes, farm engines, and other light motor apparatus use probably in the aggregate as much, if not more, gasoline than do the automobiles.

In this country there are at least 1,000,000 automobiles in use. Production of automobiles is an unknown quantity, since the manufacturing census, taken every five years, is not yet available for 1914, and the 1909 census throws no light on present-day conditions. But with one single factory announcing its hope of completing 300,000 machines in one year, and several others stating that they will produce from 25,000 to 50,000 machines in a year, it would surprise no one that in 1915 half a million machines were added to those already rolling on our 1,200,000 miles of roads.

The demand for gasoline has thus surpassed that for kerosene, once the main product of crude oil refining, to such an extent that were it not for the education of many foreign peoples to the advantages of the use of kerosene its production would have to be curtailed, which in itself would curtail the production of gasoline and thus raise its price.

In the early days of crude oil refining the various hydrocarbons were separated from crude petroleum and from each other entirely by the process of fractional distillation, the lower heats driving off the gases and then the liquids of lowest specific gravities and boiling points, the first rise in temperature separating the liquid of next highest specific gravity and boiling point, and so on, until all the usable gases and liquids had been distilled, leaving a residue which represented loss. The process can be expressed in a homely manner by comparing crude petroleum to a pile of stones of all sizes—immense boulders representing the heaviest oils, smaller ones the lighter oils, cobblestones the liquids which we know as the naphthas, benzines and gasolines, and pebbles the gases. The process of fractional distillation is a mere sorting of these various stones into different piles, each pile of which contains substantially only stones of the same size, weight, and composition.

Such a process, however, does not yield enough cobblestones for the present-day market. The yield of gasoline through simple distillation of crude petroleum will vary, of course, with the character and composition of crude petroleum used. An analysis of crude shale oil, which may be considered a fair average, shows gasoline and naphtha to be not quite 7 per cent of the total, the burning oils not quite 32 per cent, heavy oils and paraffine scale about 39 per cent, and the rest loss.

It is obvious that if every barrel of forty-two gallons crude oil yielded less than four gallons of gasoline, the United States could hardly export 183,000,000 gallons of "motor spirit" in 1913, in addition to her own enormous consumption, even with a crude oil production of 9,328,755,156 gallons of petroleum for the year.

So recourse is had to a process known as "cracking," a highly illustrative name for destructive distillation. Reverting for a moment to the several piles of stones, it will be readily understood that the man who wanted a lot of cobblestones and did not find enough in his miscellaneous pile would probably invest in a few hammers and proceed to crack some of his larger boulders into appropriate sizes.

It has been known for a long time that when petroleum is subjected to high temperatures, but without pressure, the hydrocarbons contained in it can be broken up or "cracked." Most of the hydrocarbons contained in petroleum belong to the so-called paraffine group, of which the general formula is C_nH_{2n+2}. When these paraffine hydrocarbons are decomposed it is the general rule that the resulting hydrocarbons consist in part of members of the ethylene or other unsaturated series. Just what does take place in this connection is not known, but we do know that the specific gravities and boiling points of the resulting hydrocarbons after such "cracking" has taken place are, in the main, lower than existed in the original material.

In the Burton process of "cracking" to produce gasoline, now in use by the Standard Oil Company, and for which a $700,000 plant has been erected at Whiting, Ind., this difficulty is overcome. Strangely enough, the inventor of the process can offer no satisfactory explanation of why it is successful where other and not greatly dissimilar processes fail. In dealing with chemical operations in manufacturing industries, it is often possible to get a result, and to know the exact means by which that result is attained, without knowing the reason underlying the process. Exactly the same thing occurs when we turn an electric current into a motor and produce power. We know how to do it and the means we must employ, but *why* an electric current produces magnetism and *why* magnetism acts as it does we know no more than the most ignorant savage.

The Burton process employs a container or still, provided with a proper fire box, a safety valve, a pressure gage, a temperature gage, etc., from which a pipe rises on an upward slant, which pipe is later curled into a coil contained in a tank where it is cooled with water. This pipe further leads to a reservoir, where the products of distillation collect. Beyond the condensing coil and just previous to its entry into the collecting tank is a valve. At the lower end of the coil in the condenser is a vent pipe, also provided with a valve.

The reader unfamiliar with this apparatus will see at first glance little to differentiate it from any apparatus for destructive distillation under pressure. The great difference comes in the point at which the valve is placed. In previous apparatus the valve was placed *between* the still and the condenser. By leaving such a valve closed while heat was applied, pressure could be put upon the liquids in the still, thus raising their boiling points and accomplishing a form of "cracking." For no reason which can be understood, such methods, however, when applied to fuel oil of the paraffine group formula, resulted *mainly* in gasolines of the objectionable ethylene group, with the general formula C_nH_{2n}.

(*Concluded on page 32*)

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

Review of the Year 1914

Army and Navy.

ANY review of naval and military affairs must necessarily take account of the lessons which have been taught by the great World War. Limitations of space prevent any review here of the events of the war; that must be left to be dealt with in detail in a later issue. It is sufficient in the present review to draw attention to the fact that from the opening days of the conflict to the present hour the theories on which modern armies and navies, with their elaborate and complicated *matériel*, have been built up have been vindicated to a degree and with an exactness which is really wonderful. As regards war on the sea, it has been demonstrated that battleships are the backbone of any navy, that upon these all the other units depend, and to the battleship's efficiency they all minister. Proof of this is seen in the fact that it is the preponderance of the British battleship line which for nearly half a year has been holding the main German fleet inactive within the shelter of its own harbors. In all the engagements which have taken place between the minor units—cruisers, destroyers, etc.—victory has always lain with the fleet which possessed the heavier artillery and the speed to enable that artillery to be used at most advantageous range. That much-debated type, the battle-cruiser, so far as it has had opportunity, has abundantly vindicated itself, a notable case in point being the destruction of Admiral von Spee's squadron in the South Atlantic. The scout-cruiser of high speed has proved its value on all the seven seas; as witness the wonderfully successful commerce-destroying work of the German scout-cruisers "Emden," "Karlsruhe" and their sisters, and the exploits of the British "Undaunted" and "Arethusa," designed as destroyers of destroyers, which, in the case of the "Undaunted," sank in one morning four German destroyers in a running fight. No less effective, as a type, has been the large, well-armed and swift destroyer. To these vessels has fallen, very largely, the difficult and dangerous work of maintaining a close blockade of the German ports. On only two occasions have the Germans broken through for a raid along the coast of England. The destroyer flotillas have been the object of ceaseless attack by submarines, several of which they have sunk by ramming. It is noteworthy that by keeping a sharp lookout and by dexterous use of high speed and the helm the destroyers have usually been able to detect and avoid the torpedoes of the enemy. The early losses of the British by submarine attack proved that it was impossible for the larger cruisers to maintain a close patrol of the enemy's shores. It is probable that ships of the size of the "Cressy" have been withdrawn farther off shore, and that to the swift destroyers has been allotted the work of forming the inner lines of blockade. The submarine has done exactly what the naval experts believed it would do, by forcing the larger and more valuable ships of the enemy to remain far from the home coast line. Nowhere has the German officer proved his efficiency so thoroughly as in the submarine service. Such good work has be done with the coast-defense submarines of moderate size that the advent, at an early date, of the sea-going submarine of large size and battleship speed is a certainty.

As regards the war on land, unquestionably the most impressive fact is the controlling influence which has been exerted upon the strategy and tactics of war by the aeroplane. Aerial scouting has robbed military strategy of that element of secrecy upon which it was so largely based. Particularly has this been evident in the operations in France and Belgium, where, owing largely to the foreknowledge by each Commander-in-Chief of the projected attacks of the enemy, it has been possible to maintain a balance of forces on all parts of the battle line, which has brought about conditions approaching those of a stalemate. The wide turning movement, the surprise attack in overwhelming force, splitting the enemy in two and defeating him in detail, and many of the other decisive maneuvers which carried Napoleon like a thunderbolt through Europe, are gone never to return. Field artillery has added to its reputation as the controlling element, other things being equal, in modern battle; and the stream of machine-gun bullets has established itself as a means of attack and defense, second only in deadly efficiency to shrapnel fire. In fact, it is shrapnel and the machine gun which have been doing the wholesale slaughter of the present war.

One of the great surprises of the war was the size and deadly efficiency of the German siege artillery, against whose fire the Belgian and French forts proved to be utterly helpless. The most efficient weapon is the 11-inch howitzer, which, it now appears, has done most of the work of fort reduction. The gun has attained the same mastery of the fort as the naval gun has of armor-plate on the battleship. More than ever it has been proved that the mobile field army, thoroughly equipped with field artillery, howitzers, aeroplanes and transport, is the main reliance of the land forces of a nation, either for attack or defense.

Civil Engineering.

So surpassing has been the public interest in the war that great events in the broad field of science and the arts have transpired with but a passing notice. Conspicuous among these has been the opening of the Panama Canal to the world's shipping. In spite of the great Cucuracha slide, the new and powerful dredging plant has opened and maintained a channel sufficient for the passage of ocean ships of large size. The growth of traffic has been steady and very encouraging, particularly in the trade between Atlantic and Pacific ports of the United States. Except for the slides of Culebra, which were expected and can be controlled, this great work has functioned admirably; and it stands to-day as a noble tribute to American engineering and executive ability. The formal opening will take place early in the spring of this year.

Rivaling the Panama Canal opening in importance was the completion of the enlargement of the Kiel Canal, which took place last summer. The normal width of the canal is now 335 feet on the surface and its depth is 36 feet. The twin locks at each end are 1,092.6 feet in usable length and 147.6 feet in width, as against a length of 1,000 feet and a width of 110 feet of the locks at Panama. The work of reconstructing the canal cost $55,000,000. Its strategic value in the present war is simply inestimable. Another canal of great importance to maritime commerce is that at Cape Cod, which shortens the distance between Vineyard Sound and Boston by about seventy miles, and enables vessels to avoid the exposed and stormy waters of Nantucket Sound and Cape Cod. Work has progressed steadily on the enlargement of the New York State Barge Canal, extending from the Great Lakes to the Hudson River, whose total cost, with the fifty terminals to be constructed along its course, will be about $128,000,000. Including its branches, the canal system totals about 790 miles of navigable waterways; 440 miles of this has been constructed and the remaining 350 miles lies through canalized streams. Work has progressed satisfactorily on the great Catskill water supply which will bring 500,000,000 gallons of mountain water into New York per day through an aqueduct ninety miles in length, and distribute it through a 12-foot tunnel built several hundred feet below the surface of Manhattan Island. The great Ashokan dam in the Catskills and the aqueduct leading into the city are practically completed and water may now be brought from the Catskills to augment the supply in the Croton Reservoir. An important work nearing completion is the great lock of the Government canal at Salmon Bay, by which shipping will pass from Puget Sound at Seattle to Lakes Washington and Union. The lock is 825 feet long, 80 feet wide, and 56 feet high. A vast national work of reclamation which has been the object of much favorable attention by the people of the Netherlands is that for filling in the greater portion of the Zuyder Zee. The scheme contemplates building an enbankment about 31,000 yards in length across the mouth of the Zuyder Zee and reclaiming 529,605 acres of land. The rentals from this land are estimated at $6,000,000 a year and the value of the probable crops $28,000,000. An important development in New York is the construction of a series of 1,000-foot docks to accommodate the large ships of the present day. The much-talked-of bridge (highway and railroad) across the North River has yet to be built; but during the year there was presented a most reasonable proposition and one that will probably be followed, namely, to have the bridge built by private capital and leased to the railroads and the States of New York and New Jersey, one half the rental to be assumed by the railroads and one half by the two States. The proposed bridge is to have two decks, one for highway traffic, the other for eight railroad tracks. The North River Bridge would have a central span of 3,000 feet, with main towers each about 600 feet in height. The Quebec Bridge, with a central span of 1,800 feet, the largest cantilever structure in the world, is making good progress. The piers are completed and the erection of the superstructure is under way. Another monumental bridge which has been greatly advanced during the year is the great 1,000-foot span, arch bridge, connecting the New Haven and Pennsylvania railroads, which is being built across the East River at Hell Gate. A vast engineering problem, work upon which has been pushed steadily through the year, is the control of the Mississippi River. There is a growing conviction that the method of embankment and revetment adopted by the army engineers is the only possible way to solve the problem, and earnest efforts are being made to induce Congress to appropriate sufficient money to enable this work to be pushed to completion with all the men and mechanical appliances that can be crowded upon the work.

Merchant Marine.

The most important event of the year in connection with the merchant marine was the signing of the seventy-four articles of the Convention of the International Conference on Safety of Life at Sea, which met at the close of last year in London. The most important findings are those affecting construction of ships; and on this point the Convention provided that the degree of safety shall increase in a regular and continuous manner with the length of vessels, and that vessels shall be as completely subdivided as possible, having regard to the services for which they are intended. Although the work of the Conference did not go as far as we could have wished, the ratification of the Convention by the various maritime nations will mark a great step in the direction of providing safer travel on the high seas. Unfortunately, Congress is still debating the question of ratification; and it seems likely that the safety of the general public is to be sacrificed to the convenience of the seamen. The importance of this matter was emphasized during the year by the sinking of the "Empress of Ireland," which went down in twenty minutes after collision, with the loss of about 1,000 souls. Further emphasis was laid upon the question by the burning of the "Volturno," in which it was proved that the ordinary type of lifeboat is practically useless when the disabled ship is rolling heavily in a seaway. Two more of the vast 900-foot passenger steamers have gone into commission during the year, the "Vaterland" and the "Aquitania." The former, built by Blohm & Voss for the Hamburg-American Line, is 950 feet in length, 100 feet in beam, and displaces 58,000 tons. The "Aquitania," built on the Clyde for the Cunard Line, is 901 feet long, 97 feet broad, 92 feet deep to the boat deck, and has a displacement of 53,000 tons on a draft of 36 feet. There was launched during the year by Blohm & Voss a sister ship to the "Vaterland," the "Bismarck"; and at Belfast there is nearing completion for the White Star Line the "Britannic," a somewhat enlarged "Olympic," which embodies in her hull construction all the recommendations of the London Convention as regards safety subdivision. The steam turbine continues to demonstrate its superiority as a drive for large, fast ships, and the success of the various types of transformers indicates that ultimately a combination of turbine and transformers, and to a less extent of oil engines and transformers, will become general. The mechanical drive of Westinghouse, the hydraulic reduction gear of Foettinger, and the electric reduction gear as used on our collier "Jupiter" have all shown excellent results. Certainly the most remarkable development in this direction has been the decision of our navy to install electrical reduction gear on our largest battleship, the 32,000-ton "California." This action was taken as the result of the excellent results obtained on the collier "Jupiter." The merchant marine of the world continues to show marvelous growth, Great Britain leading with a tonnage nearly one third greater than that of all the other maritime powers combined. The totals are: Great Britain, 20,275,791 tons; Germany, 4,998,746 tons; United States, 3,489,736 tons, chiefly domestic shipping; Norway, 2,475,323 tons; France, 2,246,504 tons; Japan, 1,700,062 tons, and Italy, 1,571,761 tons.

The Steam Railroads.

The most interesting development among the steam railroads is that occurring in the motive power. Although the electrification of the New Haven Railroad has been completed as far as New Haven and the electrical service is in successful operation, and although, particularly in the mountain districts, some important changes from steam to electric power are taking place, there is as yet no indication of that general

substitution which used to be predicted a few years ago. Undoubtedly electrification has been postponed for many years, at least, by the recent remarkable developments in superheating. It has been found that the use of large cylinders, moderate pressures, and superheat produces an improvement in the efficiency of the simple locomotive which is truly remarkable, amounting to 25 and in cases even 30 per cent. The promises held out when compounding was introduced, and never fully realized, have been more than realized in the introduction of superheat. The locomotive continues to grow in size, as witness the appearance of the large pusher freight locomotive built by the Baldwin Works for service over the heavy grades of the Erie Railway. The engine is a Mallet compound; but its weight and power have been increased by adding a third pair of cylinders and a set of six-coupled driving wheels carried by the frame of the tender. The boiler has 6,886 square feet of heating surface, and the steam is utilized in one pair of high pressure and two pairs of low pressure cylinders. The diameter of all cylinders is 36 inches and the stroke 32. The working pressure is 210 pounds and the drawbar pull 80 tons. The total weight of this huge engine is 477½ tons, of which 376½ tons are upon the drivers. The general movement in the direction of safer travel received impetus this year through the introduction of the new Westinghouse brake with electric control. A twelve-car steel train, 1,000 tons in weight, running 60 miles an hour, was stopped within its own length of 1,000 feet. The maximum brake capacity was obtained in 3½ seconds as against 8 seconds. A twelve-car train running 80 miles an hour can be stopped within 2,000 feet. That railway travel may be made perfectly safe, even where it is heavily congested, is shown by the experience of the New York Subway, which during the year pointed with great pride to the fact that its lines have carried 2,198,000,000 persons in the last nine years without a single passenger fatality, and this in spite of the fact that the speed and frequency of this train service are unsurpassed anywhere.

Electricity.

Undoubtedly the most important scientific event of the year was the discovery by Prof. Kammerlingh Onnes that when certain metals are cooled to a temperature near absolute zero they cease to have any measurable electrical resistance and a current started in a coil thus cooled will continue indefinitely, without any appreciable diminution. Whether this discovery will ever have any commercial application in the field of electrical engineering it is impossible to say. At present it seems unlikely, and yet all our electrical machinery of the present time had its beginning in experiments that seemed just as impracticable, from a commercial point of view, as this one. Turning to the practical side of electricity, the present war shows how indispensable this form of energy has become. We find it used in the telephone and telegraph, both by wire and through the ether; it is used at night to throw powerful beams of light; in the hospitals to locate bullets; in camp for sterilizing water. In this connection we might refer to the new United States Army portable wireless station, consisting of a motor vehicle equipped with a powerful apparatus that has transmitted messages a distance of 800 miles under favorable conditions. Wireless telegraphy has been successfully used to send messages from aircraft. With a small apparatus weighing altogether 15 pounds, the British government has been able to transmit communication from an aeroplane over a distance of twenty miles. Turning to more peaceful pursuits, wireless telegraphy has been used by the Fire Department of New York to keep fireboats in touch with headquarters and also with incoming boats that are afire. The success of this system points to the possibility of providing a deep-sea fireboat service. Before the war wireless weather service was established in the North and Baltic seas under German auspices. Significant of the intense interest in wireless telegraphy displayed by amateurs is the league, recently formed, establishing relay stations all over the country, so that messages may be relayed from Maine to California. Wireless telephony has shown progress this year. Messages were exchanged between Berlin and Vienna, a distance of three hundred miles. A portable wireless receiving outfit mounted on an automobile received spoken messages from the Eiffel Tower at a distance of sixty miles. There has been marked electrical development in the field of motor vehicles, particularly in the introduction of electrical devices on gasoline motor vehicles. To encourage touring, road guides have been distributed among electric vehicle owners in certain parts of the country, with directories of electric garages where batteries may be recharged. In Vienna, after a fifteen-month test, forty-five electric mail trucks were purchased, each of two and one half tons capacity, and with a range of twenty-two miles. An electric tractor used by the Pennsylvania Railroad for moving freight cars through streets showed, in seven months, a saving of nearly 50 per cent of the cost of operation had horses been used. There has been some progress in the electrification of railroads during the year. The New York, New Haven & Hartford system has extended its electrified zone from Stamford as far as New Haven. In Norway the government is converting its steam railroads into electric lines. Work has already begun on the Christiania-Drammen Railroad, and the government is buying up as many falls as possible to provide sufficient current for the entire railroad system of the country. Of local interest is the hydro-electric plant at Washington, D. C., authorized by Congress. By damming the Potomac 99,000 horse-power will be available. There have been many novel and curious uses for electricity during the year. In Argentine a method has been devised of electrocuting grasshoppers and their eggs. A portable plant capable of developing a tension of 6,000 volts energizes a wire screen which is placed over the ground to be treated, and by this means the insects are destroyed. Trees are similarly treated with metallic brooms having insulated handles. Some advance has been made in electroculture. One experimenter has shown that repeated applications of Roentgen rays for periods of one hundred and fifty seconds have a marked stimulating effect upon the growth of the plant. In one of our western towns a high school has been equipped completely with electrical apparatus and even with electric heating apparatus. No furnace man is required. We might continue *ad infinitum* to list the various novel uses of electricity that the year has brought forth, but the few instances cited will suffice to impress one with the continued growth and endless development of this branch of practical science.

Aeronautics.

Although no striking innovations in aeroplane construction have been brought forward during the past year, nevertheless that important advances have been made in the science of aviation is evidenced by the more perfect control that is apparent, and the increased reliability and endurance of the later models. The general results of improvement are marked, and are due to refinements of details, largely the result of continued scientific study of the underlying principles, and the experiments conducted in the laboratories that have been established for the purpose. One direction in which these studies have made themselves evident is in the increased flexibility in speed, and the possibility of flying at lower speeds than heretofore, it being recognized that the ability to vary the speed of a machine within wide limits is a practical necessity.

In the way of records there is little to report, the war intervening about the time the important competitions were due; but mention may be made of two flights from Paris to Cairo, one by way of Constantinople in eight stages. The altitude record appears to have gone to Linnenkogel, who attained 21,654 feet, as against 19,685 for last year.

A feature to which increasing attention has been given is automatic stabilizing, and many devices for the purpose have been invented, some of which have given really wonderful demonstrations of their powers, notably the gyroscope controlled device shown by Sperry in France.

The efforts for the improvement of aviation have been directed almost exclusively to purposes of warfare, but anything that tends to perfect aeroplanes in this direction will also be largely applicable to machines used for commercial purposes. As a fighting machine the aeroplane surpassed expectation, and for the work of scouting and observation it has proved invaluable in the present war.

More powerful motors have made possible machines of greater speed and also greater carrying capacity, as was evidenced last year by the appearance of the great Sikorsky plane; but development in this direction has apparently been slow.

What promised to be the sensation of the year was the flight across the ocean, in which but one candidate for the prize developed; but unfortunately, or possibly fortunately, the outbreak of hostilities necessitated a postponement of the plans.

It is interesting to note the experiments made by Curtiss with the flying machine built by Prof. Langley, which demonstrated that if a proper method of launching or starting the flight had been employed the flying machine would have arrived years ago.

Automobiles.

The only really marked novelty in the automobile field is the very recent introduction of the eight-cylinder motor, which will undoubtedly give the even, continuous torque that means so much for smooth running and increased flexibility of power and speed that is expected.

Outside of this matter of motors, the story of the past year has been one of refinement in various details and perfected standardization and processes of manufacture. Bodies have come in for a large share of attention and more careful study has been given to the artistic harmony of lines and proportions. Special efforts have been put on electric starting and lighting, and in these directions considerable improvement is noted both in durability and reliability. Efforts are also being made to produce a satisfactory and reliable device for automatically changing gears and several on different principles have been introduced that indicate much promise.

Although motor trucks and commercial vehicles generally have arrived at a very practical stage, it is to be regretted that they have not been more generally adopted. The trouble appears to lie mostly with the users, who overload, abuse, and neglect their machines and then condemn. The demonstrations of the value of motor trucks in the operations in the European war, where they are absolutely indispensable, will undoubtedly tend to awaken the commercial user to their advantages.

The year opened with considerable interest in cyclecars, just about the time they were meeting the fate abroad that is sure to overtake an immature idea everywhere. While an interesting novelty, the cyclecar has been little more than a toy, essentially of French origin, and later taken up in England. It did not take long for the more practical men of that country to recognize the shortcomings and limitations of the design and to jump to a logical conclusion by bringing out the light automobile. In this country a swarm of promoters started a cyclecar movement, which, following the history of the English movement, has failed to show signs of vitality; but a few far-sighted men with better practical knowledge of the requirements of the road vehicle have introduced really good automobiles of light power and low price which will undoubtedly take a permanent position in the market. Whatever else the cyclecar may accomplish, it has at least served a good purpose in hastening the development of a type of car that will meet the requirements of a numerous class of people.

Astronomy.

On July 21st Mr. Nicholson of the Lick Observatory photographed a faint object in the vicinity of Jupiter, near the eighth satellite, but still fainter. The new body proved to be a satellite of the great planet—the ninth to be discovered. This discovery is by far the most important of the year.

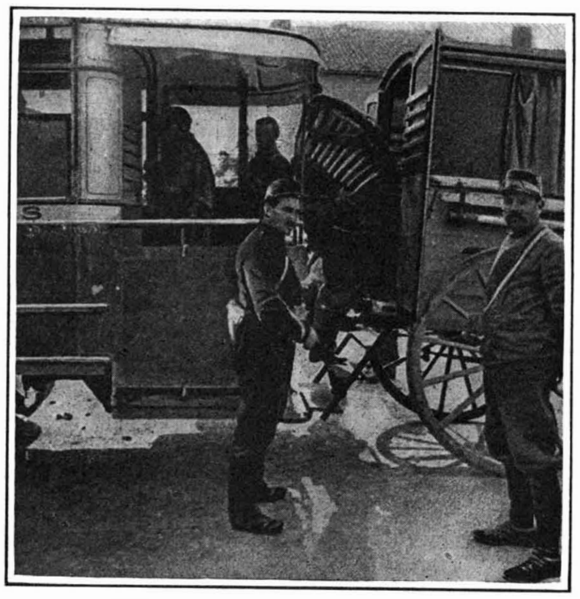
One of the principal events of the year was the total solar eclipse which occurred on August 21st. The most favorable stations for scientific observation were located in Russia. A number of expeditions established themselves at various points along the Russian part of the track. The intervention of the war unquestionably interfered with their work, but enough of them performed their tasks sufficiently well to complete the long record of eclipse observations.

On the 7th of November there was a transit of Mercury across the sun's disk. The scientific interest of a transit of Mercury is not very great, being confined to the exact observation of the times of the apparent "contacts" of Mercury with the sun's limb, which gives valuable data for determining its exact position in its orbit.

The first comet to be discovered in 1914 was detected by Dr. Kritzinger of Bothkamp, Germany, on March 29th. The second comet to be discovered in 1914 was found by Zlatinsky at Meitau, Russia, on May 15th. On September 18th Mr. Leon Campbell of the Harvard Station at Arequipa, Peru, discovered a comet which was also independently discovered at the Cape of Good Hope. Although Delavan's comet was discovered in 1913, it was a very conspicuous object in the October sky of 1914. Indeed, it appeared to the naked eye fully as bright as a third magnitude star and had a tail several degrees in length.

It has long been a question of much interest whether we receive heat from the stars, and if so, how much. Until recent years all attempts to detect and measure the almost infinitesimal amounts of energy which are radiated from the stars met with little success. No very great advance was made in this very difficult field until the present year, when Dr. Coblentz of the Bureau of Standards reported upon his work at the Lick Observatory. His apparatus will give distinct indications of the heat received from stars so faint as to be invisible to the naked eye. It was invariably found that for the same visual brightness a yellow star sends us more heat than a white one and a red star more than a yellow. Speaking roughly, Dr. Coblentz declares a yellow star of spectrum like the sun gives out twice as much energy for "heat" in proportion to its light than does a white star like Vega or Spica; while a red star like Antares radiates three times as much heat as a white one of the same apparent brightness.

The distinguished Dutch astronomer, Prof. Kapteyn, published an admirable investigation on the motions of stars which show in their spectra the dark lines of helium. As a result of his exhaustivs studies of the motion of helium stars, Prof. Kapteyn has obtained conclusive evidence that almost the whole of the stars of this type in a huge region of the sky, 60 degrees wide and 140 degrees long, extending for 30 degrees on each side of the Milky Way from Argo past the Southern Cross and Centaurus to Scorpio and Ophiuchus, are moving together relatively to the sun at least.



Loading a Paris stage with meat.

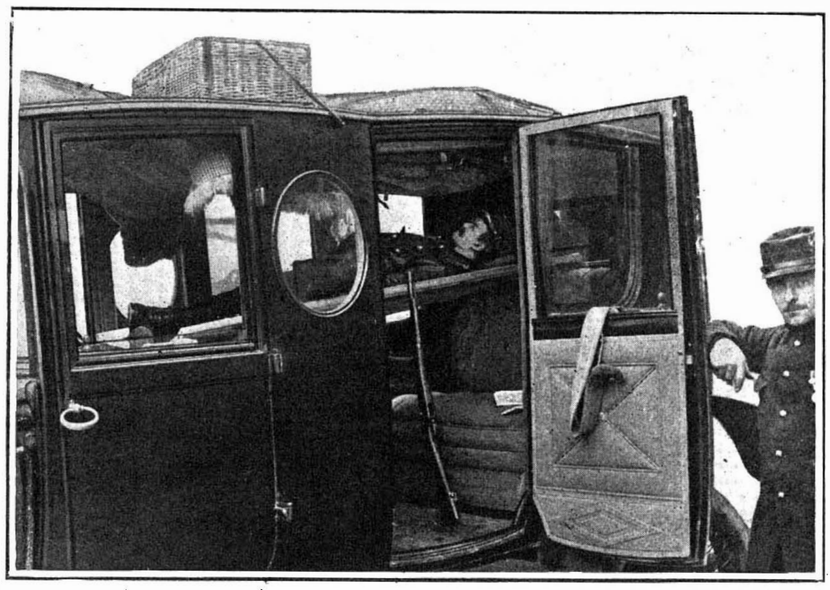
Military Tactics and the Motor

How the Power Vehicle Has Created a New System of Attack and Defense and Has Lessened the Chances of Cutting Off an Army from Its Base of Supplies

Chauffeur's port in Belgian armored car.

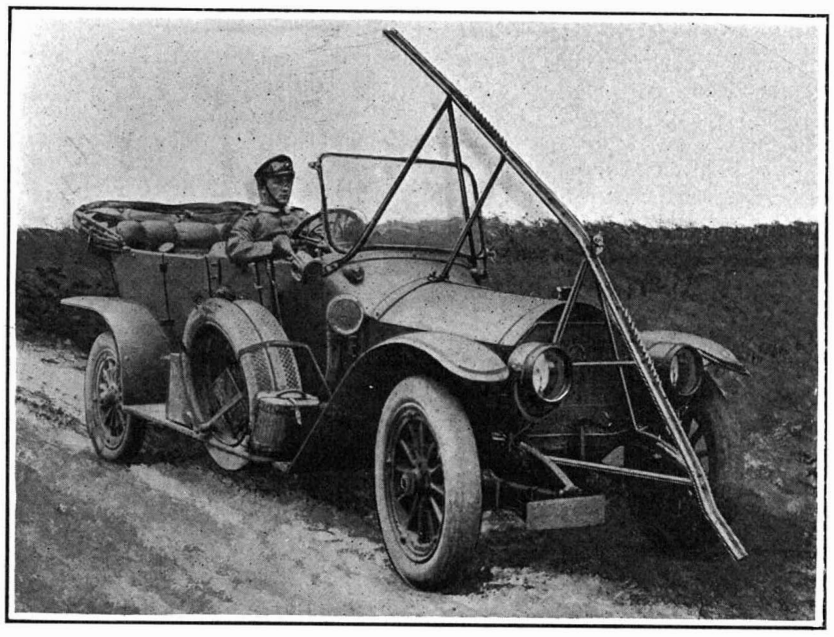
OUT of the chaos of conflicting and vague reports from the European battlefields there arises clear and pre-eminent the eulogy of the automobile and motor truck. Put to the test of war conditions for the first time since its invention, with the exception of its very limited use during the last Balkan war, the gasoline-driven motorcar has more than fulfilled the expectations of its advocates. It has almost become a tiresome "bromidiom" to say that the modern motorcar has been an important factor in the rapid concentration and transportation of armies, and that but for the motor the Germany army could not have succeeded in advancing to within twenty miles of Paris in the short space of four weeks. Even the most cursory reader of the daily press has been given to understand that the German attack in August was an attack by automobile. The attack failed; the armies have been locked in Flanders and along the eastern frontier of France for months. But the automobile has lost nothing of its importance. It has simply taken up other duties.

To give in detail all the work performed within and behind the battle lines in France and in Poland and Galicia would require a full issue of the SCIENTIFIC AMERICAN. So complete and important is the work of the motorcar that there is not a single military operation without its help or without feeling the effect of gasoline in some of its phases. From hurling heavy guns, machine guns, quick-firing cannon and armored cars at the enemy, to observing his operations behind the lines, carrying fodder and provisions for men and beasts; bringing aid to wounded, ammunition for the artillery and infantry; carrying high officers at express train speed between the various headquarters, and capable engineers from point to point along the battle line where their presence is most necessary, and a host of other incidental performances—all are "in the day's work" for the modern military automobile, and will continue until the end.



Photograph by Meurisse

How motor cars serve as ambulances.



Photograph by Paul Thompson.

Wire cutting guard used on German cars.

Motorcar Resources.

In speaking of the "resources" in motorcars in a country it is of course necessary to take into consideration that in Great Britain the government has not quite the same power to commandeer touring cars for the army as the Continental governments have. The Royal Automobile Club and its affiliated organizations have placed at the disposal of the British government about 15,000 touring cars, with drivers or owner-drivers, and the government itself has "impressed" somewhere near 6,000 motor trucks and has converted about 800 touring cars into armored cars by means of inclosing the car in thin steel shields. These converted touring cars, built to carry on an average not more than 3,500 pounds on the chassis, now are compelled to carry between 7,000 and 8,000 pounds, with the result that crystallization and breakage of chassis side frames is of rather frequent occurrence. In addition to strictly military vehicles, the government has received from private sources more than five hundred well-equipped ambulances, a great number of these being mounted on American chassis (Overland, Buick, and Ford).

In the case of France and Germany, the motorbuses and interurban motor passenger coaches have proved of tremendous value. Germany has an extensive system of passenger coach transportation run under the jurisdiction of the post office "mail coaches." More than 3,000 of these sturdy and capacious vehicles have been transformed into military vehicles, especially for meat transport to the front. The same must be said of the French buses, long lines of which may be seen at all times several miles behind the battle front.

The military authorities foresaw the great service that power wagons in general were called upon to perform in the event of war, and, as in all the leading countries, they endeavored to have all the

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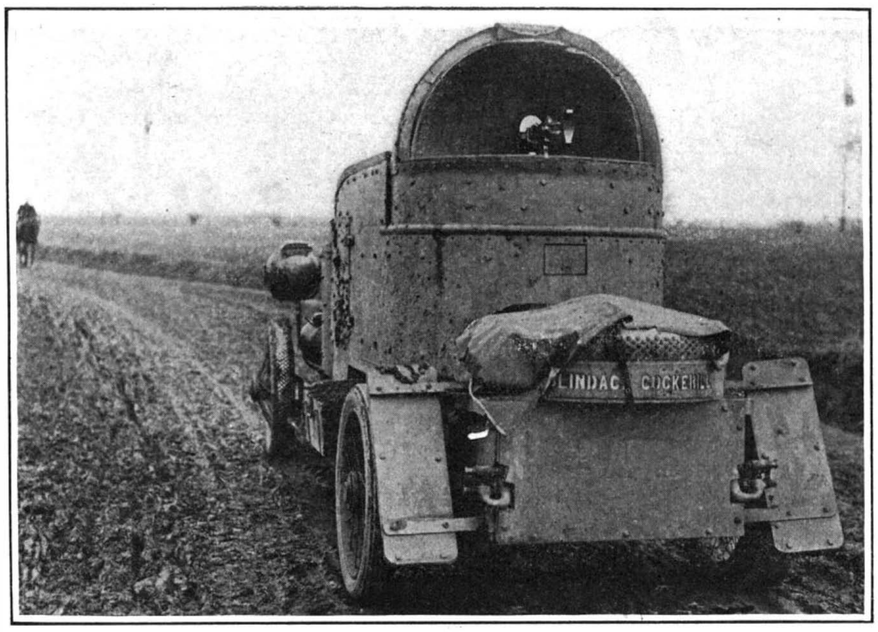
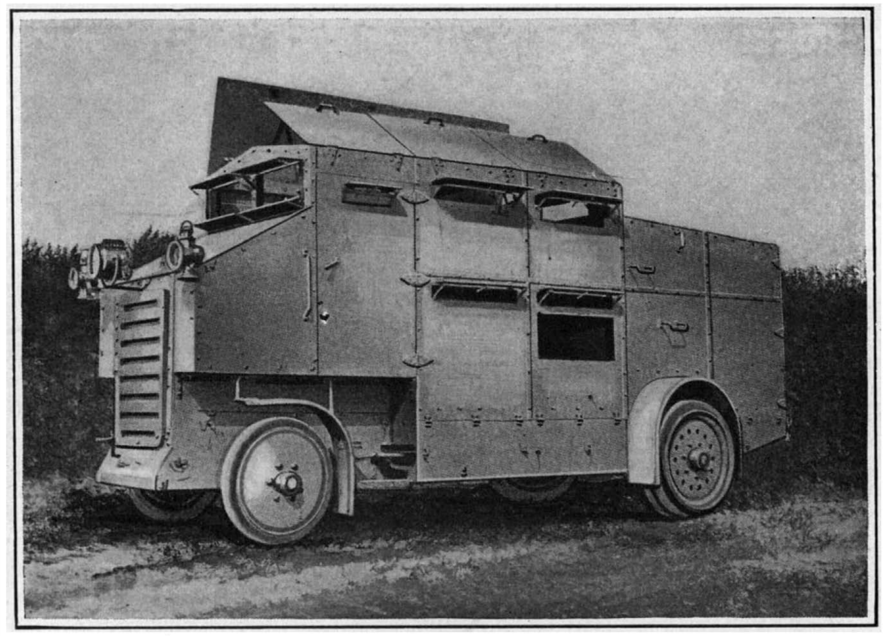
The Canadian contingent on review at Salisbury Plain, England. The cars were built in the United States.



Photograph by Meurisse

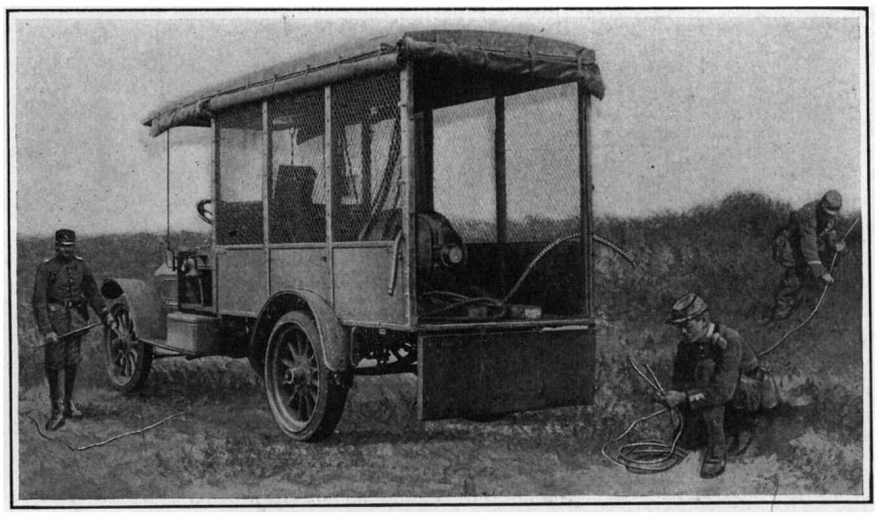
Belgian armored car, showing the revolving turret.



Heavy English armored car, a fort on wheels.

power wagon trucks including the ones used with autobus body, built according to the general standard regulations laid out by the War Department. In this way the trucks of the autobus are in reality a type of power wagon chassis which conforms to the same standard rules as apply to the larger power cars. The Paris bus employs two different types of motor and truck combination, one being designed by the Schneider works, the great artillery and machine works, and the second by the De Dion automobile builders.

Since the war broke out the autobuses have entirely disappeared from the circulation in the city and the whole number of these cars has been enrolled from the very outset of operations in the carefully planned service for supplying provisions to the army on the field. No less than 1,100 buses were thus available, and they are now engaged in following the troops in the course of the battle. About 900 of them were taken for the transportation of fresh meat in quarters, and the inside of the vehicle was quite transformed by taking out all the seats and partitions so as to leave a roomy space for holding the quarters of beef, these being, as a rule, hung upon hooks from the roof. A single autobus can hold a very large number of pieces, so that the whole fleet is able to handle enormous quantities of meat, such as are needed for the immense number of troops engaged in the war. The remainder of the vehicles, or about 200, are designed for the transport of troops, and this can be done in a very rapid manner on occasion, either to help out the railroad or in other cases where railroad facilities cannot be had. Again, for emergency cases or rapid maneuvers, a considerable number of troops can be instantly sent to a certain point of the battle either in autobus or on other kinds of power wagon, and this might often change the issue of events. It is also probable that a few of the buses are fitted out for ambulance work, and one of our photographs shows a bus transporting some of the Algerian troops.



Motor truck fitted with an electric generator for field use.

Photograph by Meurisse

German prisoners conveyed by motor truck to Châlons sur Marne.

Owing to the careful construction of the automobile chassis and motor, the cars go through their daily work on the battlefield with their heavy loads, and the military authorities are more than satisfied with their performance. It was considered fortunate that just within a few years Paris had adopted the present extensive autobus system, which led to building over a thousand cars a short time before the war broke out. As to the way the cars stand the wear of this hard service, they say it is very good, and with the exception of three or four cars laid up and four or five in repairs all of the great fleet of buses continue to circulate over the roads.

Turning to the question of transporting the food supplies for the troops, and especially the handling of quarters of beef, the present organization is excellent. Large troops of cattle follow the armies over the roads and are convoyed by soldiers. At the headquarters where the troops are stationed a suitable place is selected in a town or village or at any chosen spot along the route and improvised abattoirs are installed, usually in buildings and grounds, where the mobilized butchers are at work slaughtering cattle and cutting up the beef in quarters. From the abattoirs the autobuses receive the meat, which the soldiers load upon the vehicles in rapid order; then the fleet of cars start off upon the road to a point lying nearest the battlefield. Here the meat is changed over to the covered army horse wagons of light build, and these are able to travel over fields or other ground so as to reach the rear of the fighting line; then the army cooks receive it and proceed to prepare the rations for the men.

Watching the Motor at Work.

The popular conception of lines of infantry in trenches, interspersed with motor convoys loaded with ammunition, etc., is pure folly. Motor convoys are miles

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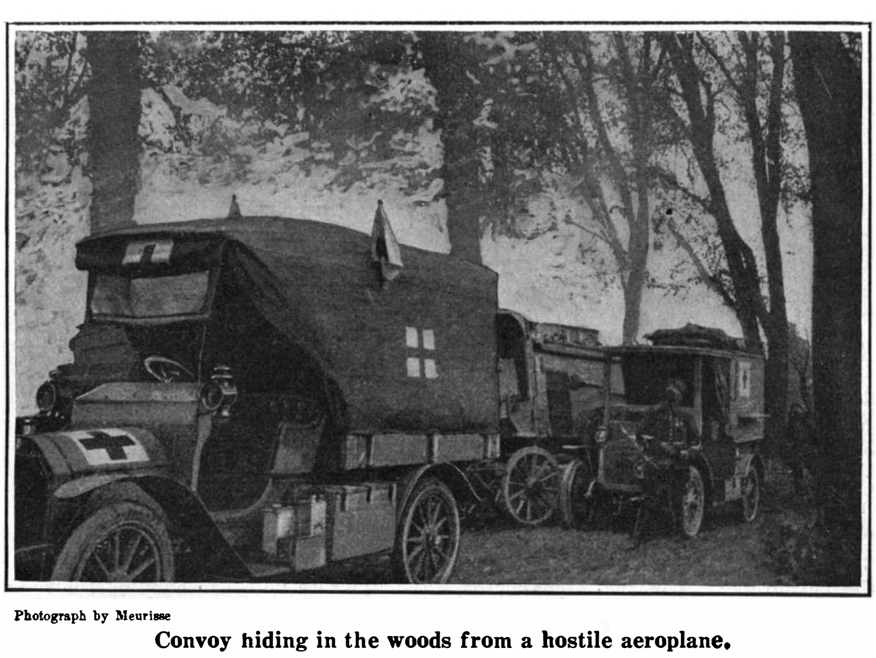
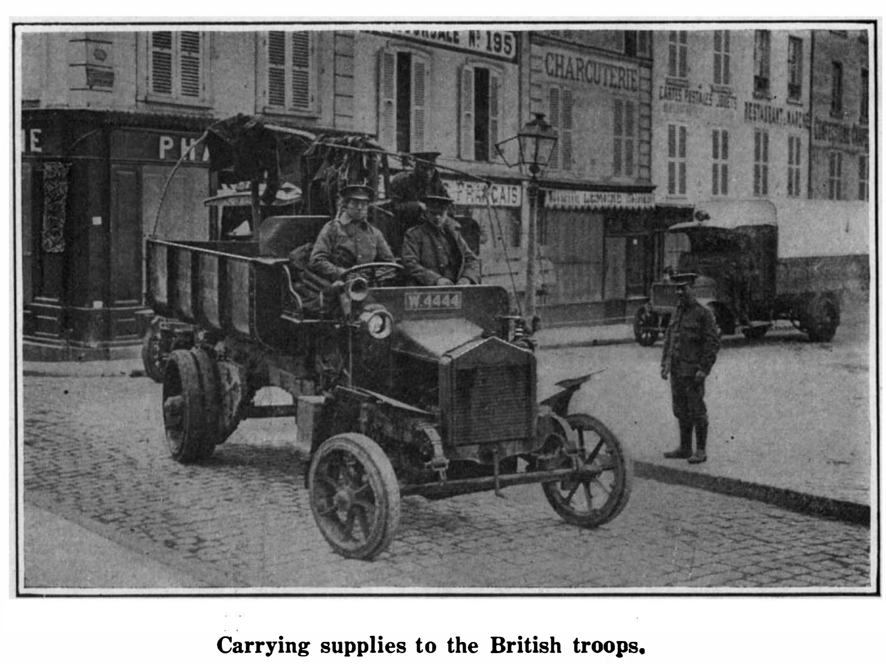


Photograph by Meurisse

Convoy hiding in the woods from a hostile aeroplane.



Carrying supplies to the British troops.

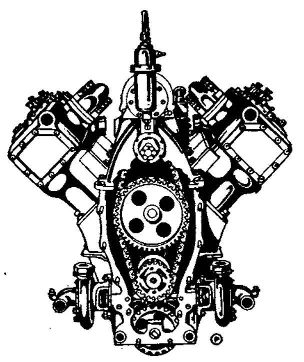
The Car of 1915

Some of the More Important Changes Ushered in With the New Year

By S. P. McMinn, M.E.

DURING the past twelvemonth there have been a number of developments in the motorcar world, which, perhaps, are not as plainly apparent to the layman as they are to the student of matters gasoline. Also, there are a number of trends of the times which must be plainly apparent to all who have eyes to see.

Not the least important of the developments of the past year has been the commercializing of the eight-cylinder motor. Or should we say popularizing, for the motor of this type long has been successfully used by our brothers across the seas. But it is characteristic of American progressiveness that those who have been instrumental in bringing the eight-cylinder motor to native heather have not been content to follow blindly the example set by French pioneers. In constructional features and design they might have looked far and perhaps in vain for better engineering in so far as the mere drawing of the plans is concerned. But engineering extends further than the draughting table; it extends out on the roads and comes close to the pocket-book of the ultimate consumer. So American engineers have been free and frank in their adoption of practice long acceptable abroad, but they have applied to it American engineering principles; which means, briefly, quantity production and a popular price. As a result, we now have two American eight-cylinder motors, one selling for just under $2,000 and the other selling for less than $1,500. Shall we have more? It seems more than likely.

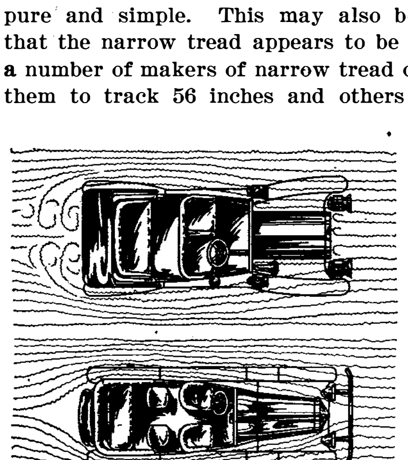


An eight-cylinder motor.

From the eight-cylinder motor it is but a step to the motor with twelve cylinders. So far only one foreign maker has attained success with this type of motor, and here again it is characteristic of American progressiveness that already several well-known American makers are known to be experimenting with motors of the kind. Whether the experiments will bear fruit, whether we shall see twelve-cylinder motors competing with eight-cylinder ones, remains for the future to bring forth. And in this connection it must be remembered that there were those who were outspoken enough to predict that the eight-cylinder motor never would become popular under the American flag.

The light-by-comparison six-cylinder car which was such a feature of last year's crop of machines continues to hold its own, though it might require a stretch of the imagination to see it making the strides that were freely predicted for it. As a matter of cold fact, the still-lighter-by-comparison, small, high-speed, four-cylinder motor appears to have made greater strides in the year, and by comparison, than has the six. Another significant feature is the increase in the number of cars which sell at or near to the $1,000 mark.

At the same time it is interesting to note that the well-defined division which existed between the miniature car and the larger one fast is disappearing. It has come to be regarded as distinctly unhappy and undesirable that there should be any division as between classes of cars. Instead there is a marked tendency to place all four-wheeled vehicles in the one class. The so-called cyclecar, for instance, has been practically pushed over the horizon, and it is now a motorcar pure and simple. This may also be taken to mean that the narrow tread appears to be passing. Already a number of makers of narrow tread cars have widened them to track 56 inches and others give evidence of appreciating the failing popularity of the narrow tread car by offering the option of either narrow or standard width.

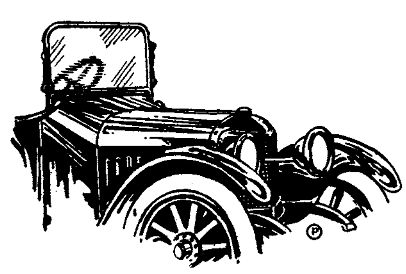


"Streamlines."

The outward appearance of the car of 1915 has not changed very much. Yet there is a subtle something which almost involuntarily brings to mind and expression the saying: "Clean as a hound's tooth." The blending of lines, which first gave promise about four years ago, when fore doors on touring cars were one of the dominating notes, has become an established fact, and practically every car, regardless of class distinction, now has the streamlines which last year were a feature of a comparatively few.

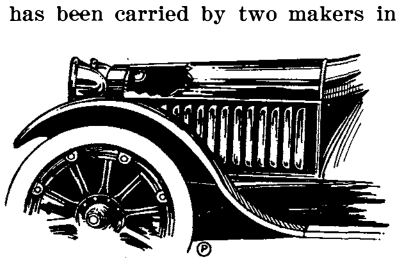
This term "streamline," by the way, has become a common one, yet there are not many among the ranks of motorists who know its significance. It means, briefly, that the designer has taken advantage of the entering wedge principle, and has at least in part converted wind resistance to his own uses. In other words, he has conserved some of the wasted energy represented by displaced atmosphere by training the eddy currents to help push the car along.

He has done this by tapering the engine hood and in some cases by fitting a pointed radiator; by gently flaring the body sides and carefully eliminating all external protuberances; by clearing everything off the running boards; by rounding the fenders; by giving thought to body lines at the rear, where once no thought was bestowed. The result, of course, is a much more efficient car and one which is driven on less gasoline and lubricating oil.



The pointed radiator.

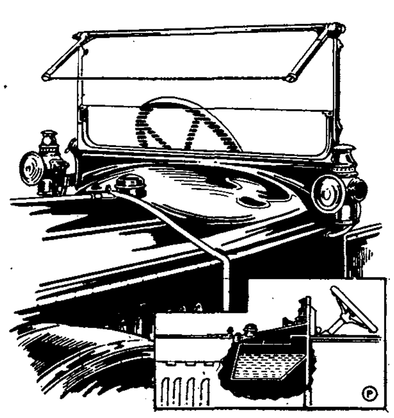
Here are two notable examples of how far the smoothing process has been carried by two makers in the popular-price class. One of them has even eliminated the time-honored and not always sightly radiator filler. He has placed it beneath the engine hood, and in this way obtained smoothness where it was not obtainable before. The other has substituted for the usual door latches a magnetic device, which is entirely inclosed both inside and outside. To open the doors you merely press a button.



The radiator filler concealed.

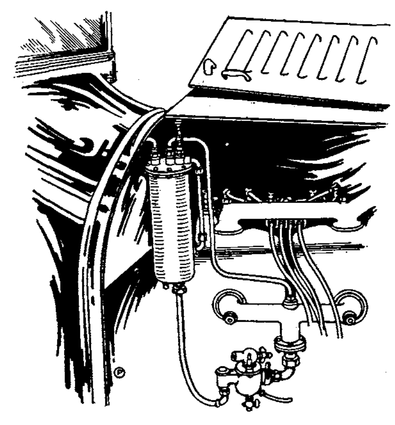
Left side drive is now almost universal, and there is nothing new in that except its widespread adoption. There are not more than three or four makers who still adhere to the right side position for the steering wheel.

Quite generally, now, the fuel container is carried either beneath, or rather in, a deep cowl over the driver's feet where before there was waste space, or at the rear of the body. This was one of the noticeable tendencies last year. The cowl-located tank indicates no difficulty in feeding the fuel to the carbureter, for gravity may be relied upon. But the rear tank has been responsible for the development of a new method of getting the gasoline from the tank to the engine. The use of pressure feed is open to many objections, and now the necessity for it has been obviated by the development of what has come to be styled vacuum feed.



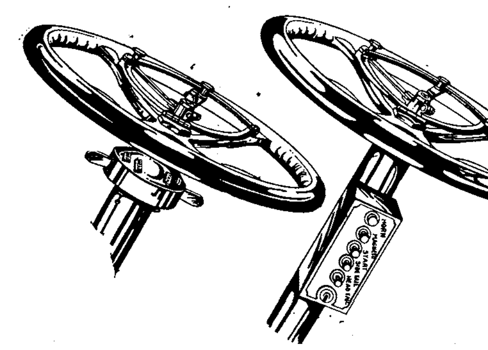
The cowl tank.

This vacuum feeding device, which now is quite common and bids fair to be more common, consists of a small tank placed generally on the forward side of the dashboard. There are two compartments to the tank, the upper compartment being connected to the main fuel tank and the lower to the carbureter. The suction induced in the intake manifold of the motor is caused, through suitable piping and valves, to draw fuel from the main tank into the upper compartment, whence it drains by gravity into the lower compartment and thence to the carbureter. The device is entirely automatic in action.



Vacuum feeding device.

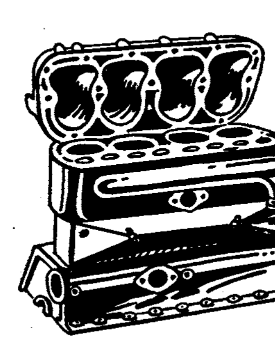
Along with the convenience that comes with center control of the gear shifting and emergency brake levers, there is a well-defined tendency to place all other control devices within easy reach of the operator. Thus, for instance, switches, carbureter adjustments, etc., now are being placed on what have come to be styled cowl boards, directly in front of the driver. At the same time, there is a noticeable trend toward the adoption of switchboard units mounted directly upon the steering column.



Switchboard on the steering column.

Wire wheels may now be had on the majority of cars at a nominal extra cost, though there are not many makers who supply them as standard equipment. That they have made some advance there is no gainsaying, though it likely will require another year before they are entitled to the descriptive adjective common.

In the vitals of the car, one of the most noteworthy features, as already has been chronicled, is the increase in small-bore, high-speed, four-cylinder motors. The increase in the type has served to draw attention to the fact that the method of casting all four cylinders—and in the case of six-cylinder motors all six cylinders—in one block grows apace. Another of the past year's developments which has lived up to its promise is the steadily increasing use of a detachable cylinder head. This construction simplifies somewhat manufacturing operations and at the same time increases accessibility and facilitates the easy removal of carbon deposit. The use of cored intake and exhaust passages also shows a slight increase. With the now almost universal adoption of electric lighting and engine starting equipment—there are not more than three or four makes of cars on which this equipment is not listed as standard—has come what may be styled a logical reversion to battery ignition. Given the storage battery as part of the car it is such a comparatively simple matter to arrange to draw current from it for ignition that quite a number of makers have eliminated high tension magnetos as a result. Others, however, prefer the proven reliability of the magneto and the complete isolation of ignition and lighting functions. But on the popular priced cars the modern battery ignition system, brought to the plane of perfection where mechanical and electrical lag has been practically eliminated, undoubtedly has won a place for itself and will not soon be ousted.



Detachable cylinder head.

The lightening of reciprocating parts goes forward, and of late still greater attention is being paid to the necessity for more perfect balancing. As a concrete example of this fact we might state the case of one maker of Knight motors who has adopted the practice

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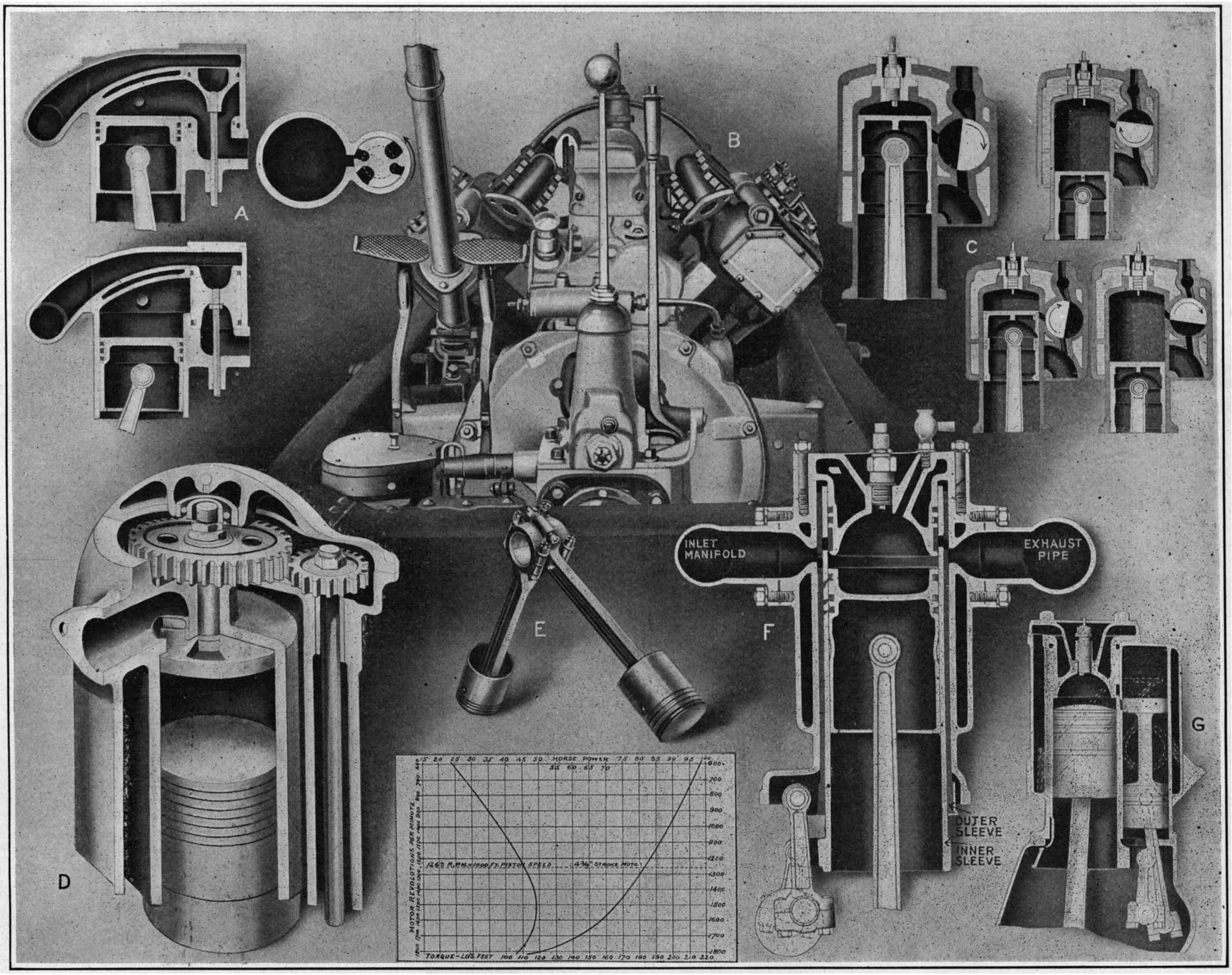


Various types of high-speed motors.

A, odd rotary valve action of the Italia motor; *B,* the eight-cylinder Cadillac motor; *C,* action of the Darracq D-form valve; *D,* the Reynolds rotating valve disk; *E,* pistons of the Cadillac motor; *F,* valve sleeves of the Knight motor; *G,* the Miesse combination sleeve and piston valve. The chart shows a laboratory test on a four-cylinder 5 by 5½ slow-speed motor for power and torque. The strangling effect of the valve is plainly apparent.

The High Speed Automobile Motor

Relief it Promises From the Growing Burden of Weight and Increased Running Expenses

By Charles F. Barrett

IN spite of the large amount of discussion and experiment on the subject of the high speed gasoline motor for automobile use, very little progress has been made so far on this side of the water in the perfection of such units along successful commercial lines. In France and Germany, and particularly in the former country before the war broke out, wonderful results had been attained with this type of motor, although not in any marked degree as regards size of output, when the latter is judged from our American standards.

On close analysis of the problems encountered in the commercializing of this type of motor in this country two or three facts stand out prominently as having a vital bearing on the situation. One of these is largely psychological; one a result of habit, and the third based upon actual structural difficulties.

The first two of these really date back to the very beginning of the industry in this country and relate to the early impression formed by motorists of the satisfactory speed of the motor as well as its control by the gear changes. Most of the pioneer manufacturers were so engrossed in the problem of actually making their motors run that they gave little heed to the important subjects of vibration and balance. The result was, naturally, a very disagreeable vibration whenever it was necessary to speed up the motors on either low or high gears, and a popular dislike was therefore created for small bore motors which of necessity required relatively low gears and frequent gear changing.

Consequently the demand was for large bore, relatively slow speed motors which could be geared fairly high and thus loaded down sufficiently to hold the unbalanced effect within reasonable bounds. The poor balancing evil thus caused an unwarranted prejudice against the high speed motor right at the beginning of the industry, and having once started in this rut manufacturers naturally took the path of least resistance and, instead of attempting to swing the public back in line, encouraged them to keep on believing that the slow speed motor was the correct type with no alternative.

Hand in hand with this development came a strong liking for high gear driving. The infrequent gear changing necessary with the large bore type of American automobile motor has undoubtedly taken firm root upon the majority of motorists in this country and the habit resulting from long use of this form of control has been practically a national characteristic.

It is therefore necessary to realize at the outset these two basic dislikes of the American for the high speed motor; one, an old, moss-grown suspicion that vibration and poor balance go hand in hand with high speed, and second, a genuine hatred for gears and gear changing. The latter feature cannot, of course, be separated thoroughly from high speed design, because the torque falls off so rapidly when the motor speed is pulled down that slow, high gear work under load is not practical, and gear changing must be rather frequently resorted to, with four cylinders or less.

It has taken years to overcome this deep-seated prejudice of the motorist in this country for the so-called high speed type of automobile motor and there is no assurance that it has been overcome even now, but there is at least some marked evidence of widespread kicking against the ever-increasing cost of the present type of motorcar, particularly as regards upkeep. This is beginning to cause a decided reaction in favor of the high speed type on account of the relief which it seems to promise for a very material reduction in the present burdensome total car weight with its chain of expense. In other words, we are fast getting into a mood to accept what appears like a lesser evil in order to overcome a greater.

It should be said for the large, slow speed type of motor, however, that during the early period of the industry it was unquestionably the most practical type from the purely manufacturing standpoint. Just as the introduction of the successful automobile itself was contingent upon the development of the high grade alloy steel, so the high speed type of motor has had to wait for the perfection of valve mechanisms, lubrication and other vital features, before it could be considered a feasible proposition.

On the structural side of the problem there are four principal features which demand careful handling in the design and manufacture of this style of motor, as hinted at above: First, relative proportion of parts; second, valve mechanism; third, lubrication, and fourth, balance. Any one of these is fully as important as the other three, and whereas in the slow speed type if some of these conditions were not perfectly fulfilled it did not necessarily spell failure of the motor; in the case of the high speed type, it would mean utter impracticability.

The high speed automobile motor calls for a most exacting proportion of all component parts; a careful,

(*Concluded on page 37.*)

The Storage and Handling of Gasoline in the Garage

A Discussion of the Various Systems in Use

By Herbert T. Wade

THE chief aim in the construction of a garage should be to provide an absolutely fireproof structure, and this condition is insisted on more or less in municipal and insurance regulations. The modern concrete building has facilitated a fireproof garage in a marked degree, but distinction usually is made in official regulations between public and private garages, with naturally considerable leeway in construction for the latter. Given the garage, the storage of gasoline involves compliance with such requirements as those of the National Board of Fire Underwriters and municipal authorities, for it must be remembered that from the time the drums or barrels of gasoline are delivered at the garage it is a source of increased hazard to the premises and the surroundings.

The safety of property must be considered before any questions of convenience and expense to the garage owners; and while gasoline must be stored where it is subject to a minimum of loss by evaporation and where it can be supplied readily to the motor vehicle, yet it must be in such a place that the least possible danger will result from leakage or from the escape of vapor that may be reached by a chance flame or spark, not to mention the actual loss in fuel itself by evaporation, especially in summer, or with rapid fluctuations of temperature. There must be some pumping and piping system for its distribution, for insurance and fire regulations generally forbid the handling of gasoline in open containers.

Naturally there is the greatest safety when the gasoline is kept underground, and experience has shown that with a properly vented and otherwise protected storage tank underground adequate safety can be secured, irrespective of the size of the tank or the quantity of liquid contained. Tanks above ground are permitted by fire and insurance regulations only under special conditions and in rural districts. With the gasoline stored underground there is no danger from evaporation or leakage and consequently whatever troubles are encountered must be found in its handling, and here likewise it is necessary that suitable precautions be enforced.

To remove the liquid from a buried tank some form of pumping system is required, and this may vary from a simple hand-lift pump to a motor-driven pump or a system employing hydraulic or gas pressure. Naturally the pipes must be made tight by cement, impervious to the action of gasoline, properly protected, and so arranged that the filling hose or other outlet appliance is such as to present a minimum of risk.

The underground tank is made of galvanized sheet steel or wrought iron, riveted, welded or brazed, the material, thickness and other essentials complying with specifications prepared by the Underwriters' Laboratories or equivalent specifications of a local authority. Such a tank is buried below the ground at least three feet and may have separate fill and suction pipes and a vent pipe terminating some distance above the tank in a goose neck. The fill pipe when not in use must be capped properly and protected from access of air, being arranged so that it can be locked to prevent tampering, and it should extend to the bottom of the tank and contain one or more strainers of wire gauze, which also afford protection in case the flame should reach the fill pipe opening. The suction pipe, which must be at no point lower than the top of the tank to avoid explosion or gravity action in case of fire, naturally leads to the pump and may be supplied with various valves and strainers as may be required. The best forms of suction pumps deliver a steady stream of fluid through the hose to the car or to some form of portable receptacle, such as a bucket or safety can.

Wherever simple pumps are able to furnish adequate supply a hand pump is to. be preferred, even for a garage of considerable size, as the supply ceases when the attendant stops pumping. Such pumps are located in proximity to the place where the discharged supply is to be utilized and there may be a considerable length of line communicating with the underground tank. With such a pump and tank system it is found desirable to introduce a number of additional features so important as to be considered almost essential—for example, a device at the pump to drain back into the tank any surplus gasoline, and various straining and measuring appliances, the latter also recording the amount of gasoline actually delivered.

As the size of the installation is increased the pumping and distribution system naturally becomes more complicated, though essentially it is the same as in the simple installation, and if power pumping is introduced automatic devices usually are applied to stop the flow after a predetermined quantity has been delivered. In a large garage a measuring pump is essential, and these are supplied in various forms, with its cylinder carefully graduated so that each stroke of the piston delivers a fixed quantity of gasoline, the amount of which may be regulated by certain adjustments so that from one pint to five gallons may be delivered at a single stroke of the pump piston. The most complete pumps also have a meter registering the quantity of gasoline delivered, a filter and two-way nozzle, and a hose with portable nozzle for convenience in the operation of filling a car.

While the location and size of the tank may vary with local fire department or other regulations, whatever its size, the systems in general nature are essentially the same, and our illustration shows a gasoline supply station located at the curb with the storage tank buried under the sidewalk, though the general arrangement would apply equally to a large garage with a battery of tanks and a number of pumps. The arrangement shown with its red pedestal is familiar to traveling motorists. Such a tank is filled from drums or barrels or a tank wagon through a fill pipe reaching to the sidewalk, while its vent pipe extends to the side of the building and rises to a considerable height. These pumps must be constructed tightly fitting and of a design approved by the Underwriters' Laboratories, by whom they are labeled, and their accuracy should be carefully certified by local sealers of weights and measures.

A large public garage, where the gasoline is stored and handled by pumps, may be operated by a remote control system which can deliver the fluid from a storage tank, sometimes of as much as 11,000 gallons capacity. In one such type of installation a centrifugal pump connected to an electric motor is located at some convenient place within the suction distance of the storage tank. On the discharge line from the pump, which may extend up through several stories, one or more remote control, automatic, self-registering pipe line measures, equipped with oil separators, strainers, etc., are placed any distance from the pump convenient for using. The measure or measures are operated from a special electrical control equipment opened or closed either by hand by the attendant, or, if automatic appliances are introduced, the supply will be shut off automatically by the measure when the predetermined quantity has been recorded. This system has been elaborated so that several lines of hose may be connected with a single pipe line and by the use of an automatic control valve, so that a discharge end may be located at the curb for the use of tourists.

Although a mixture of gasoline vapor and air is highly explosive, yet so safe are these underground tanks when duly protected that at the time of the San Francisco fire one hundred and eighteen of the outfits of a single manufacturer installed in that city were found intact, and the inflammable fluid contained was pumped out and removed with a surprisingly small shrinkage from leakage and vaporization, not to mention complete protection from the fire. In one case a tank was found to contain over 200 gallons of gasoline after an interval of three years.

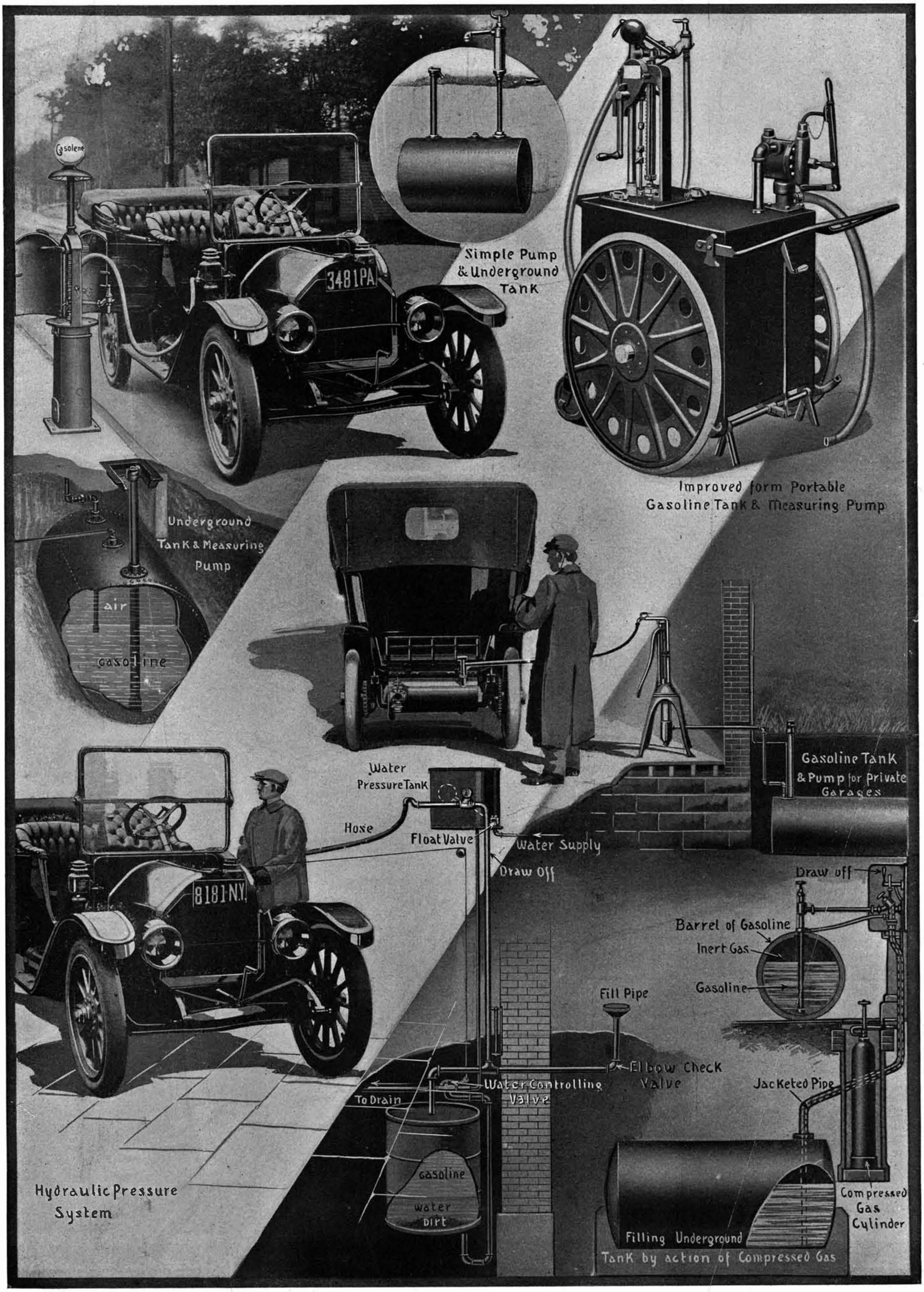
The distribution system based on the simple pump has the advantage of being complete in itself without connection with water, sewer system or compressed air, or requiring any outside material. It answers for installations of any size and the only essential is that there must be a supply of gasoline in the tank.

Mention here might be made of the familiar portable tanks where a number of cars, especially in garages or along the roadside, must be supplied with gasoline, and an elaborate system of piping is not desirable or feasible. In such an installation storage tanks are maintained with outlets and valves at convenient points, especially of the various floors of garages with several stories, and from them are filled portable wheeled tanks from which the gasoline is supplied through measuring pumps and hose with strainer nozzles to the individual cars as required, the portable tank being brought up to the car at its place of rest. The design of these tanks as well as the number is usually regulated by local insurance and fire regulations, tightness and stability being, of course, prime essentials, and as they can be moved by one man readily, they are convenient for transferring gasoline and reaching cars wherever they happen to be placed.

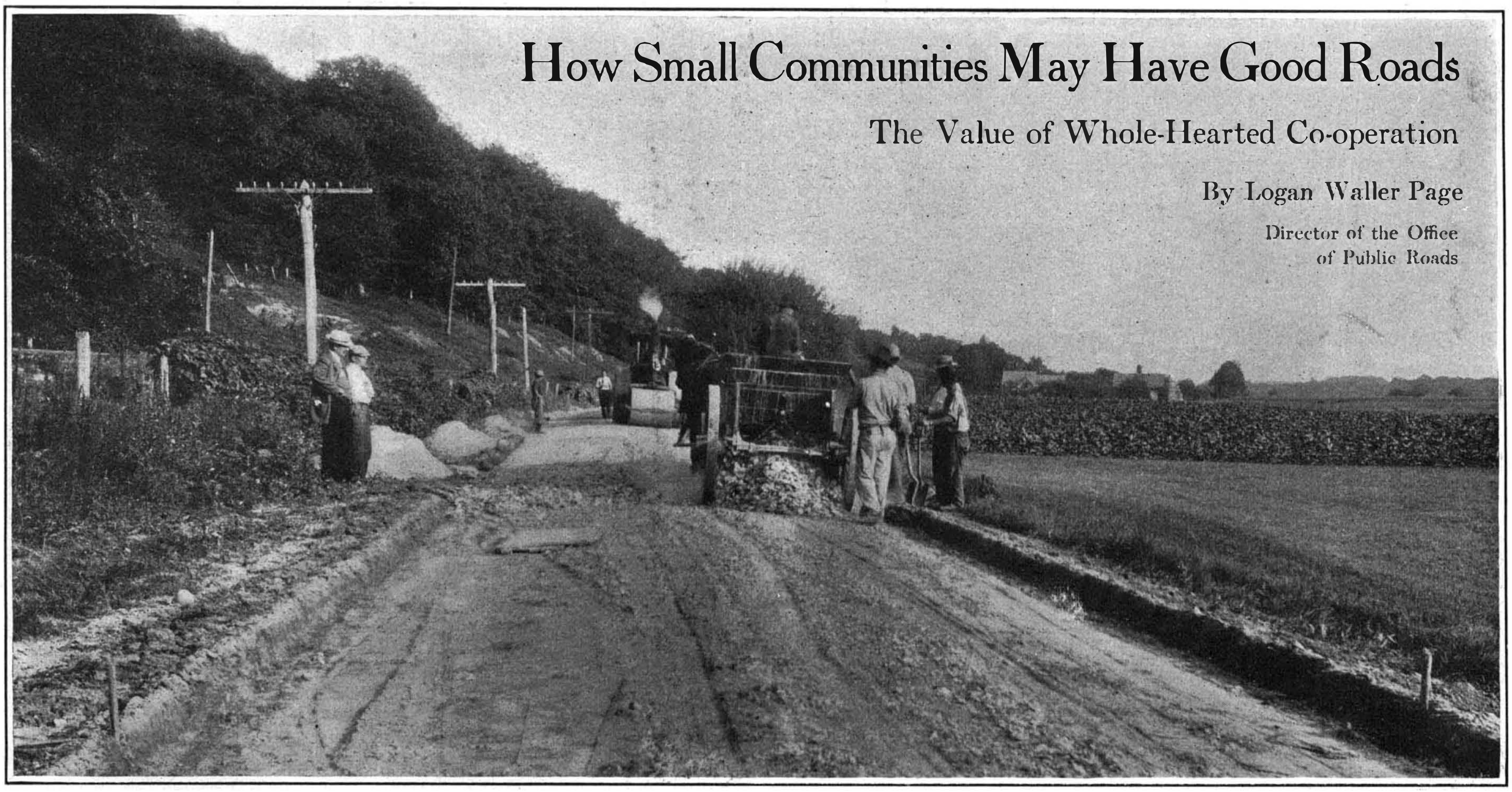
As contrasted with pumping systems where a simple air pump raises the gasoline, there must be considered the hydraulic system, where water pressure is the motive force. In these there is no air at all in contact with the surface of the gasoline, with the possible production of an explosive mixture, and the gasoline can be measured accurately both on admission to the tank and on being discharged, since in the latter case the liquid flowing through the meter is pure gasoline and not a mixture of air and gasoline or water and gasoline, which cannot be recorded satisfactorily. The hydraulic system is used in garages of all sizes, from the simple private installation to such a one as that of the American Express Company in New York with 500-gallon tanks having a capacity of 13,000 gallons. It acts on the following principle. The gasoline is contained in an underground storage tank which connects by a U-tube with a water pressure tank at such height as to furnish a proper pressure based on the difference between the specific gravity of water and gasoline and the distance to which the gasoline is to be delivered. This water tank is filled from the city mains and a float-cock maintains a constant level pressure. If water from the tank is admitted to the system by opening the three-way valve it will flow through the U-tube and into the gasoline tank, rising to an equal level in both arms of the U-tube. The gasoline on being discharged from the drum or barrel is admitted through the filling pipe and flowing down on top of the water in the supply tank causes the water below to be discharged through the drain at the water controlling valve on the water supply line. The gasoline stays on the surface of the water and the dirt settles to the lower part of the tank. On account of the lesser density of the gasoline a higher column will balance a lesser column of water in the proportion of 17 to 11, these figures representing the relative density of water and gasoline. When it is desired to draw off the gasoline this valve is opened, so that the pressure of the water in the tank acts on the gasoline in the storage tank, forcing it up through the draw-off pipe into the hose used for filling the tanks of the cars, a check valve preventing its return through the filler pipe. When sufficient gasoline has been passed into the tank of the motor vehicle or other receptacle the valve is closed, cutting off the water pressure from the pressure tank, and the normal condition of the liquid in both arms of the U-tube is restored. The amount of gasoline drawn off can be measured from a meter placed in the line of the draw-off pipe, and since the amount of gasoline supplied to the storage tank obviously must be equal to the amount of water displaced, which flows off through the drain, an accurate water meter can be installed in the pipe line to the drain to measure this quantity. Chief of the advantages is that the clean gasoline can be drawn off from the top of the tank and it is impossible for water or dirt to be drawn with it. There is no vent pipe open to the air or surface of gasoline in contact with gasoline. Furthermore, there is no air space, as the tank is always full of liquid, and hence no evaporation can take place or generation of explosive gases. The dirt and water at the bottom of the tank are forced into the drain when the tank is refilled. Like other systems which fill directly the main tank, no portable tanks are required, so that there is a minimum of fire risk. There is, of course, a waste of water through the drain, but the expense for this under ordinary circumstances is relatively small.

In addition to air lift and hydraulic systems, there have been employed extensively in Europe systems which use as head an inert gas such as nitrogen or carbon dioxide in contact with the surface of the gasoline, and carried in an annular space or jacket surrounding all pipes through which the inflammable liquid passes; as combustion is impossible in the presence of either of these gases their effect is obvious. The most notable of these systems, whose principle of operation is indicated in the illustration, was described in the SCIENTIFIC AMERICAN for July 18th, 1914. Its safety has been fully demonstrated not only in garages, but also in other establishments where large quantities of inflammable liquids are stored. It possesses the disadvantage of being dependent upon compressed gas supplied in cylinders to furnish pressure acting within the tanks. It is, however, thoroughly fireproof, and when well installed, as it has been in Europe, has supplied adequate protection and secured general official approval.

All of these systems have met with the approval of insurance authorities and where they are installed they are meeting the requirements. Care and maintenance enforced by insurance and official inspectors, however, are quite as essential as original installation, but the tendency toward uniformity and codification of local rules is bringing about a much more satisfactory and safer condition of affairs.



THE STORAGE AND HANDLING OF GASOLINE IN THE GARAGE



How Small Communities May Have Good Roads

The Value of Whole-Hearted Co-operation

By Logan Waller Page

Director of the Office of Public Roads

THE public roads in the United States, outside of incorporated towns and cities, have a total length of 2,228,042 miles, of which only 229,219 miles, or a trifle more than 10 per cent, are improved with any form of surfacing. Any means which promise to increase our small mileage of improved roads should, therefore, be given consideration and utilized to the fullest extent possible, with due regard for true economy and proper efficiency.

Possibilities in Co-operation.

The marked success of certain co-operative undertakings by farmers and rural communities, especially in the marketing and distribution of agricultural projects, has given the mere word "co-operation" a certain standing and distinction as indicative of the successful solution of all problems. But co-operation is to be judged from the results obtained. Certain forms of co-operation are efficient and successful, while others, even though seemingly successful, are extremely inefficient and entail a large waste of energy. For example, in certain sections, it has become popular to proclaim "Good Road" days, on which everybody is supposed to don overalls and labor on the roads. This is very commendable as a demonstration of interest and enthusiasm, but so far as securing adequate returns from the energy expended, it is far from ideal. It is, in fact, but a variation of the old system of statute labor, of which we have been trying so hard and so long to rid ourselves. The main distinction is, that in this case the labor is voluntary and made somewhat less onerous because of the hurrah and attendant advertisement. It sounds good to read in the papers of the eminent statesmen, bankers or men of business donning overalls and laboring with pick and shovel to mend our ways. This, no doubt, furnishes adequate compensation for the sore muscles and the few blisters, but how about the efficiency of this labor? If anything has ever been clearly demonstrated, it is the inefficiency of unskilled labor in road work. The time of the business man who cheerfully gives up his energy in more or less misdirected efforts to improve our roads can, on the average, probably be placed as worth at least the equivalent of five days of a common laborer, trained and efficient in doing this class of work. As unskilled labor is rarely more than 50 per cent efficient, it follows at once that this much advertised bit of altruistic endeavor, however, commendable from an idealistic point of view, is from the standpoint of economy only 10 per cent efficient.

Economic Efficiency the Test.

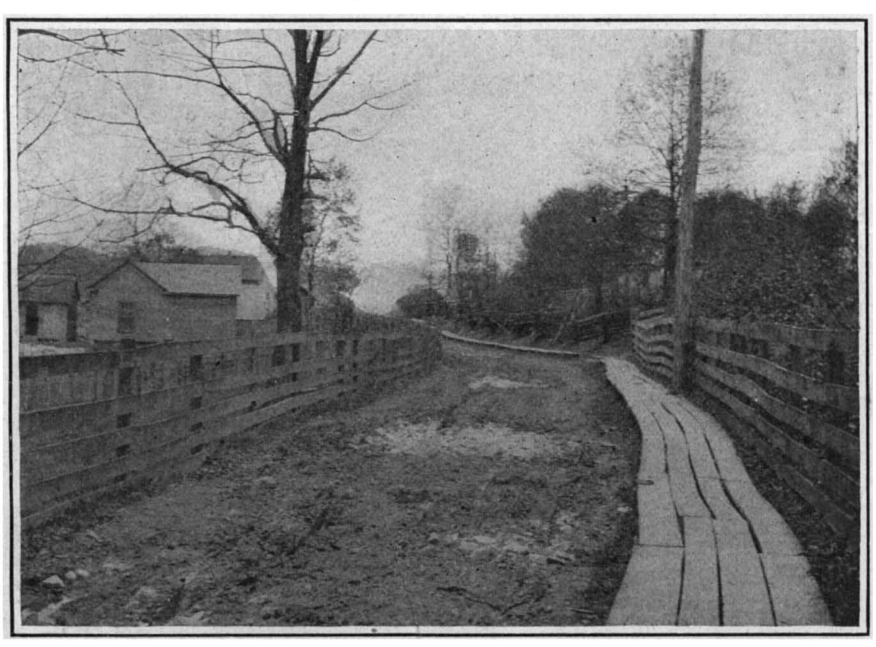
Co-operative as well as other public undertakings must ultimately stand or fall before the searching test of economic efficiency. Any co-operative undertaking, no matter how commendable its object, ought never to be tolerated, unless it is more efficient than the system it displaces. Our endeavor should constantly be directed toward a system which will ultimately yield us 100 per cent efficiency.

This does not means that co-operative undertakings have no place in our public road system. From the very beginning of road building in this country the roads were considered a local burden, in the construction and maintenance of which all should co-operate, each according to his ability. Where a road lay on the boundary of two towns, or other administrative subdivisions, legal channels were fixed, whereby both would co-operate in the construction and maintenance. Later, as the more general importance of our public roads began to be understood, legal channels were formed for such varied co-operation as the abutting property owners, the town, the county and the State. To-day, neither townships, counties, nor even State lines limit the general interest taken in the condition of our roads. The automobile and the motor truck have made the conditions of the roads of the country of direct interest to all. The automobile and the motor truck demand better and more permanent types of construction. Through routes or trunk-line roads have become a necessity in some localities. Certain branch roads and feeders are of only slightly less importance. From 60 to 75 per cent of our roads, however, still carry little or no through traffic, and so remain primarily of local importance.

Trunk Lines and Branch Roads.

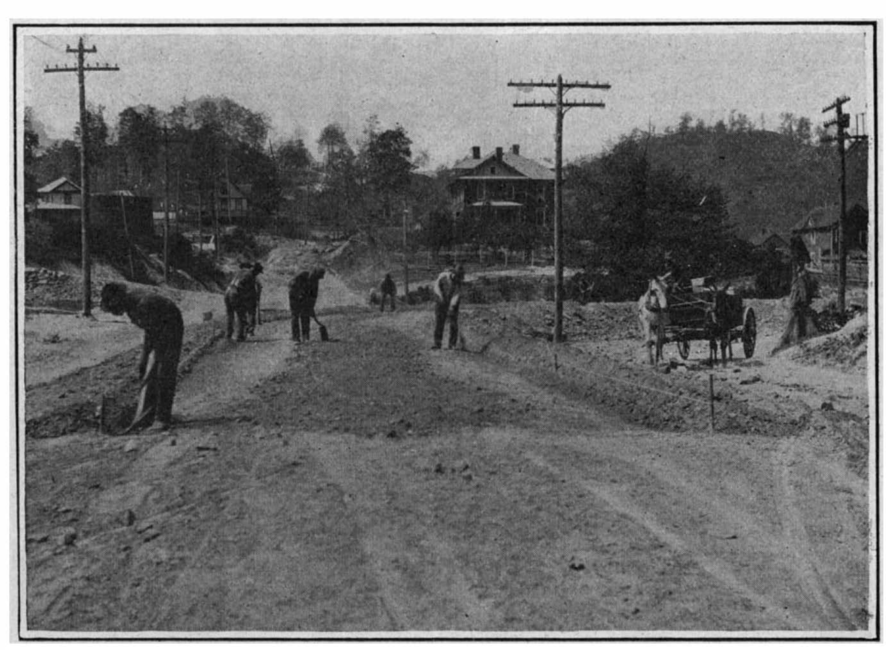
Most of our States have recognized these natural divisions of our public roads. No State has as yet, however, made this division on the purely scientific grounds of amount and kind of traffic carried, but several have made more or less happy attempts to secure the same results by utilizing, in general, our administrative units to make the several classifications. This has given us, in most States, a division into State or State-aid main roads, county roads, and town or township local roads. Massachusetts has only two subdivisions, State and town roads, while New York has four classes, State highways, county highways, county roads, and town roads.

While most of the States co-operate only directly in the construction of State or State-aid roads, a few have already realized the importance of directing local co-operation for the improvement of our minor roads. New York and Pennsylvania have established State bureaus of town highways, while Massachusetts has established



Misdirected efforts.

he energy required to fill the mudholes with boulders been expended in providing proper age and maintenance with a road drag, this might have been a good road.



Properly directed efforts.

A trained and properly organized labor force under efficient management can always be depended on to secure a dollar's worth of returns for every dollar expended.

It takes more than enthusiasm and good intentions to make a good road.

a somewhat similar division for aiding and co-operating in the improvement of town roads.

Proper Planning, Management, and Funds Necessary.

When our highway system is viewed from the broad standpoint of its efficiency as a public utility, it becomes evident at once that there are three fundamental requirements which must be fulfilled: First, a properly planned, classified, and laid out highway system; second, a proper and effective system of road management; and third, the provision of adequate funds. From a study of these fundamental requirements, it can be seen that undirected co-operation between local communities is apt to lead to costly mistakes. A small community is not likely to view the improvement from the larger interest of the county or State, and systems of efficient management and skilled labor are generally lacking. Furthermore, the town or township is frequently too small to form an efficient unit for road management and administration. The funds are too small to warrant the employment of a capable highway engineer and the purchase of modern road machinery. Certain forms of co-operation are, therefore, desirable in order to secure a large road fund, skilled supervision, and the use of efficient machinery. Vermont has solved this in part by the appointment of a county road supervisor, who co-operates with the town road officials, and so, in a way, helps to co-ordinate the road work of the entire county properly. New York and Pennsylvania have established bureaus of town highways which direct and guide, to a large extent, the road work of the several towns throughout the State. The work is thus systematized, plans are standardized, and there is co-operation along definite and well directed lines.

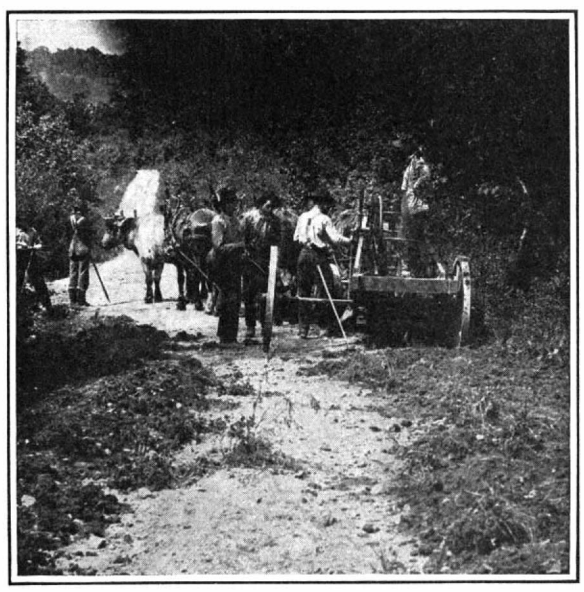
Various State Systems.

Other States have nearly the same system, but with a county unit instead of a State bureau. But, as the county organization is more or less subordinate and responsible to the State Highway Department, the distinction is one of degree, rather than of kind. Some of the more important examples of this system are Iowa, Illinois, Wisconsin, and Minnesota. While there are many dissimilarities in the highway organization of these States, there is one fundamental and striking similarity, the effort to secure reasonable co-operation throughout the various units, and, at the same time, provide a fixed, definite responsibility for all actions. Other States, such as California and Montana, do not use the township organization in their road work. The county is the unit, which may, however, be subdivided into districts according to the will of the Board of County Supervisors. The tendency here, however, is very strong against the old method of subdivision, and in favor of a county unit with a capable engineer in charge of the road work.

This explains why many of our States are formulating means for directing the work of the local communities. The most conspicuous examples of co-operation are to be found in such States as have a State Highway Department or Bureau, especially provided for giving efficient guidance and direction to work of this character. Under these conditions and with the above limitations clearly understood, co-operation between local communities in road building may be carried on with considerable success.

Preparatory Steps.

In making preparations for co-operation of this kind, the first point to be considered is that all our public roads are by law under the jurisdiction of one or more public officials. Before any definite work can be done, it is necessary to secure the consent of the officials having charge of the road to be improved, or what is far better, to secure their co-operation and support. The second step is to secure competent advice in regard to the improvement to be made. It would be extremely unwise, for example, to place a macadam or bituminous surfacing on a road where gravel or sand-clay would answer all the requirements. It would also be a waste of money and labor to reduce a grade to 1 per cent where a 3 per cent grade would answer as well. On the other hand, it would be just as much folly to place a gravel or sand-clay surfacing where traffic requirements demanded bituminous construction, or its equivalent, or to leave a grade 7 per cent where traffic demanded a 3 per cent grade. In other words, over-investment and underinvestment are both bad. Both lead



Working out the road tax.

to loss of time and labor and money. The aid of a little really expert advice when the work is being planned will save the community much loss and needless worry. The second point may, therefore, be restated thus: Get competent advice as to what to do, and then follow it!

The third step deals with the actual construction of the road. This usually requires funds, labor, materials and the use of more or less machinery. In securing these there is room for the exercise of any amount of genius and ability. The one essential requirement is

Road near Bowling Green, Kentucky, built by co-operation of the county and local farmers.

to secure the maximum efficiency from the expenditure of the funds and labor.

Example of Methods.

As an example of the great diversity of ways and means that may be employed in getting work done, the following cases may be cited: Nearing Bowling Green, Kentucky, the main market roads had been macadamized by the county. The local roads, however, were unimproved. A number of farmers decided to improve these branch roads, over which they had to pass in order to reach the main roads. During the plowing season all the rocks encountered in the fields were picked up and thrown in piles. Later, when the crops were in, and time available, these stones were hauled to the county rock crusher. County co-operation had been secured to the extent of furnishing and operating a crushing plant and a road roller. The farmers then hauled the broken stone and placed it on the roads. The actual cash outlay of the county for the crushing and rolling was at the rate of $500 per mile for roads ordinarily costing $3,000 per mile. The farmers, moreover, secured good roads and cleared their fields of stone at the same time.

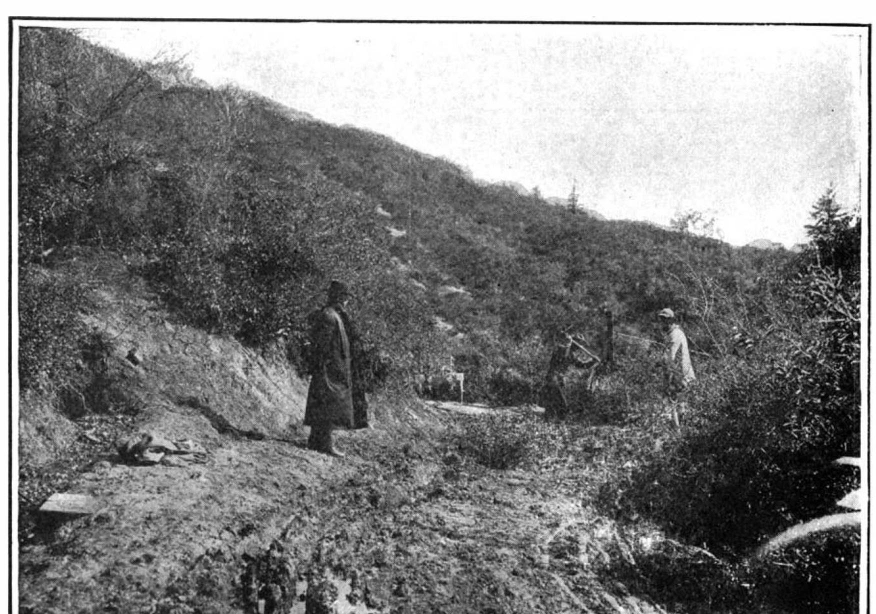
An example of civic pride, rarely equalled, was shown in the little village of Friendship Heights, Maryland. When the Rockville pike, which passes through this place, was being resurfaced, it was proposed to use a somewhat cheaper surfacing through the village, because of lack of funds. The ladies of Friendship Heights, however, would not be satisfied with any surfacing which was not equal to the best to be found on the road. From the engineer in charge of the work on the road they ascertained the amount necessary to supply the deficiency, and at once set about to raise the funds by holding a bazaar. It is needless to say that the money was duly raised, and, thanks to the ladies, the village of Friendship Heights has as fine a road as any part of the Rockville pike.

A Commercial Club Assists.

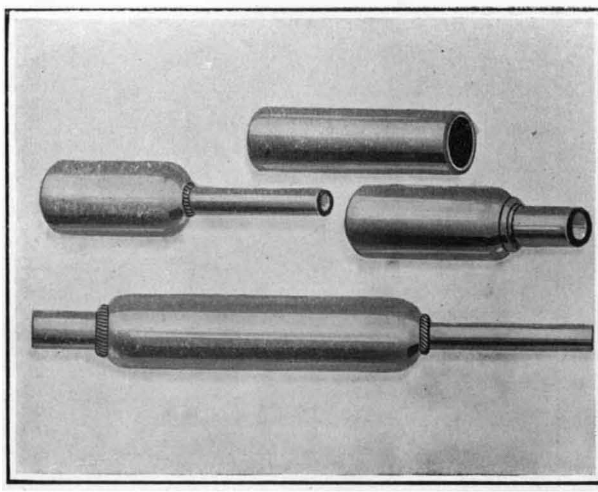
In Hartington, Nebraska, the Commercial Club became convinced that one of the greatest needs of the region was good roads. During a considerable portion of the year some of the roads leading to the town became so bad that farmers were unable to come to town except on foot or horseback. There were thus long periods of dullness and little or no business. An agreement was finally reached by the Board of Supervisors,

(Concluded on page 38.)

The engineer making the layout of what is intended to be a properly planned and constructed road.

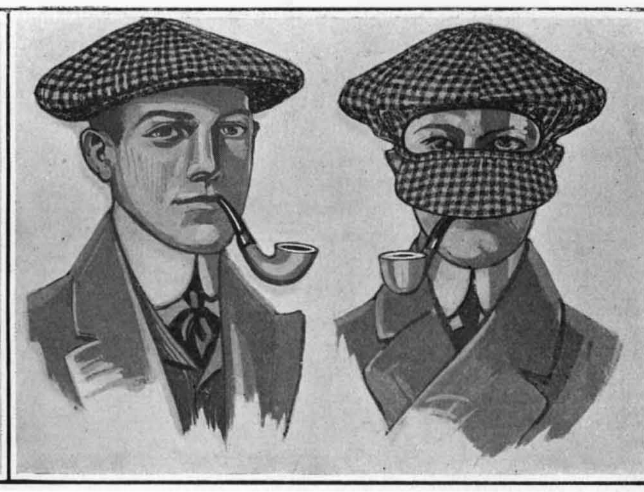


Enthusiasm and misdirected labor a poor substitute for trained labor and skilled supervision.



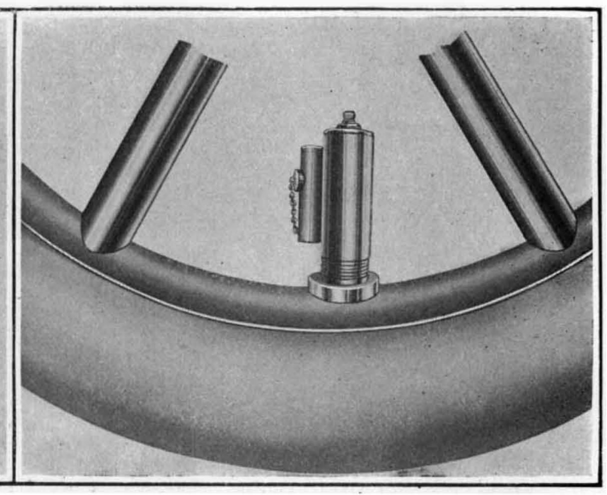
Sanitary drinking tube.

A compact quill-like device, made of aluminium, and containing a bone charcoal filter. When the two end parts are withdrawn from the cylinder and placed with the smaller tubes projecting outward a combination "drinking straw" and filter is formed, that lessens the danger and adds to the comfort of drinking from wayside streams.



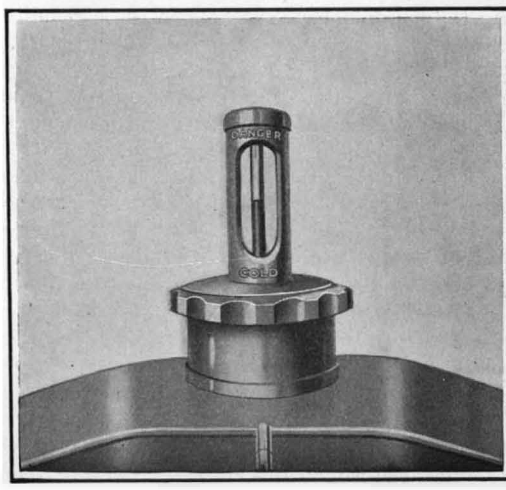
A universal cap.

This has a tinted celluloid window that ordinarily folds up out of sight in the crown, but if you run into a cloud of dust, bugs, cinders, or driving rain, with one hand the visor and window can be instantly pulled down to protect the face and eyes, while the sight is not interfered with in the least. The cap is made in a great variety of patterns for both men and women.



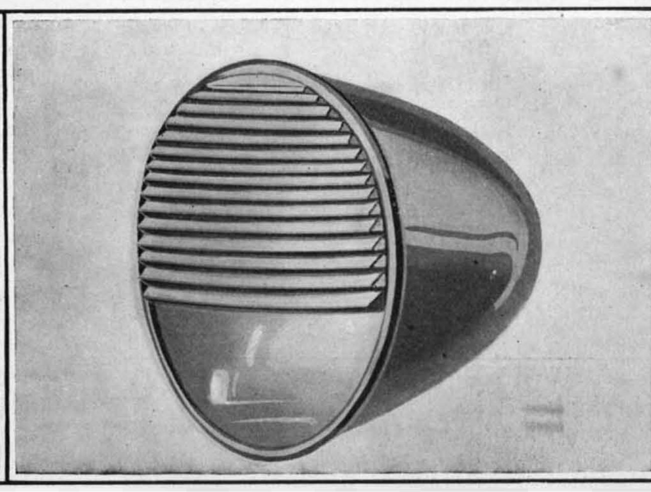
Low-pressure tire alarm.

A cylindrical device intended to be attached to the valve stem and provided with a whistle, which is automatically set in action as soon as the air pressure in the tire to which the alarm is attached, falls below a certain predetermined amount. A valve in the alarm enables the signal to be turned off if it is necessary to drive farther with the deflated tire before repairs can be made.



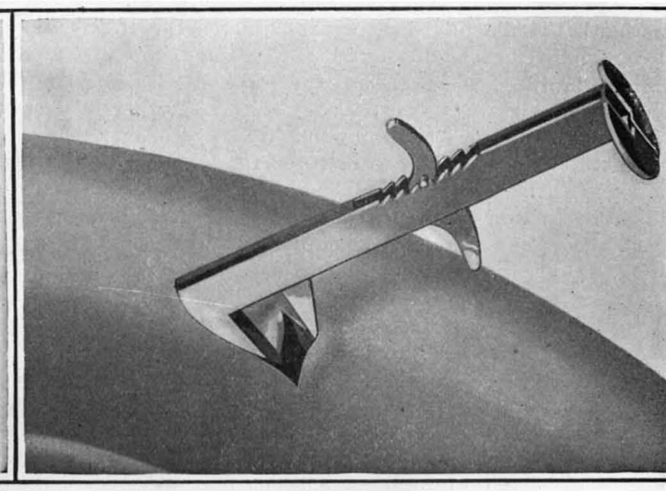
A check on overheating.

A long-stemmed thermometer, inclosed in a glass and nickel cylinder to insert in the radiator cap, so that the temperature of the cooling water may be seen by the driver without leaving his seat. The stem is of such length as to remain always in the water.



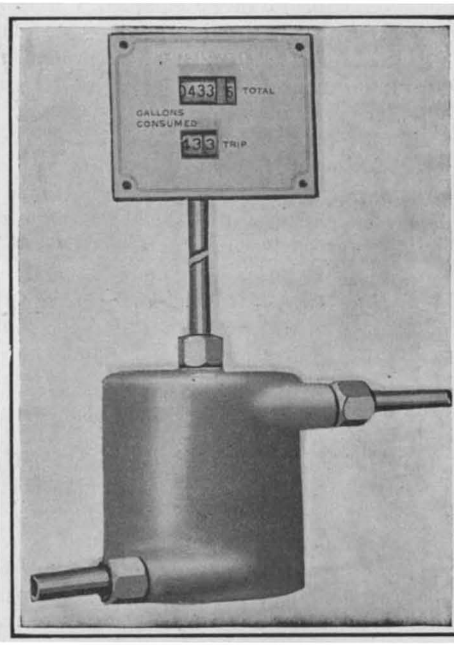
Deflector headlight glasses.

A headlight glass provided with horizontal corrugations in its upper half, constituting prismatic lenses. These prisms collect the greater part of the light, and direct it downward and forward, increasing the illumination of the road; but allow enough diffused light to pass directly, to constitute a warning to those in front, without dazzling their eyes.



A tire repair tool

An ingenious tool, consisting of one fixed and one movable jaw, the latter operated by means of two finger triggers acting in notches cut in the upper edge of the shank. By drawing on one trigger the space between the jaws is widened and a cut in a tire or tube may be spread apart and held in place while the cut is cleaned. A pressure on the other trigger releases the movable jaw.

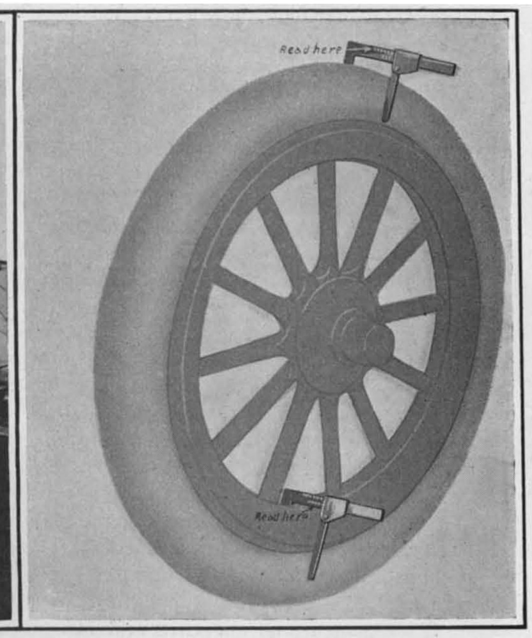


Measuring the fuel.

This is a compact meter to place on the dash that will accurately measure the fuel consumed, regardless of speed of flow or pressure. This enables the owner to check expense and waste.

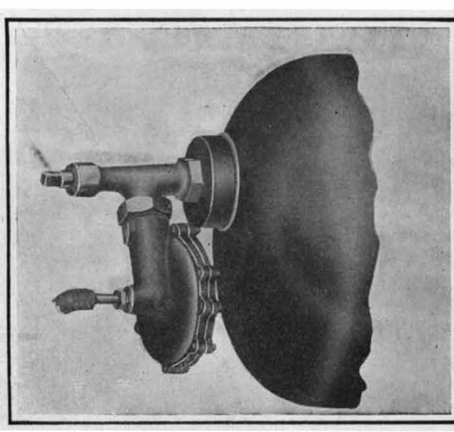
A comfortable auto robe.

This heavy, woolen lap robe is provided with pockets in the bottom for protecting the feet of the occupants of the tonneau; and by means of properly arranged snaps the upper portion of the robe, which is in the form of an apron, can be drawn closely around the throats and shoulders of the occupants. This is made in both single and double widths, the latter having two pairs of foot pockets and two aprons.



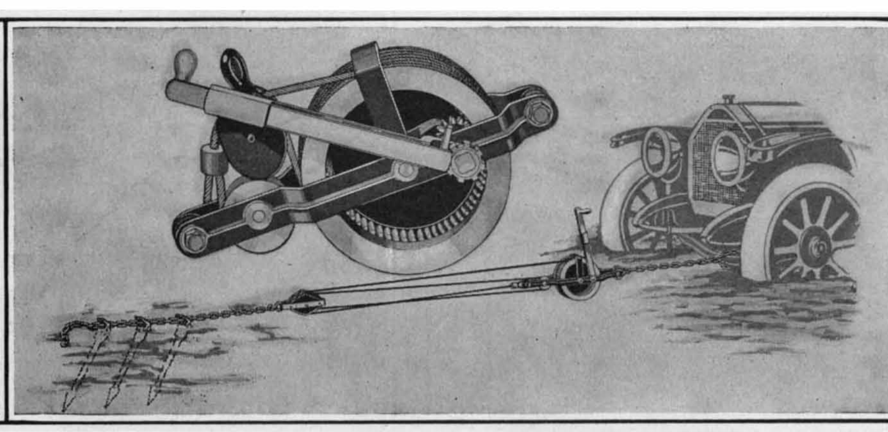
Tire caliper.

This instrument determines the amount of flattening of the tire at its point of contact with the road. The scales give the comparative diameter of the tire at point of greatest load, and at the point diametrically opposite.



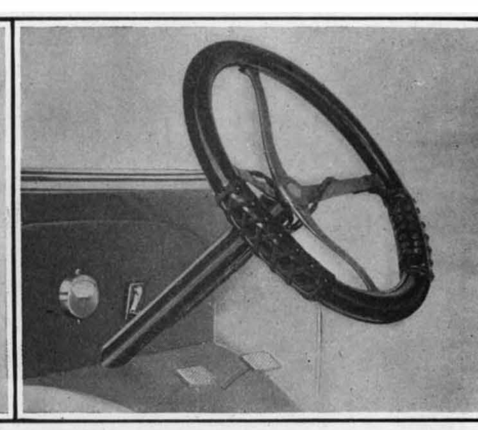
Pressure-reducing valve.

This is attached to an acetylene gas tank and furnishes the gas at a constant pressure to the burners, regardless of the tank pressure. The gas valve may be opened wide without the danger of a high flame at the lamps.



A rescue windlass.

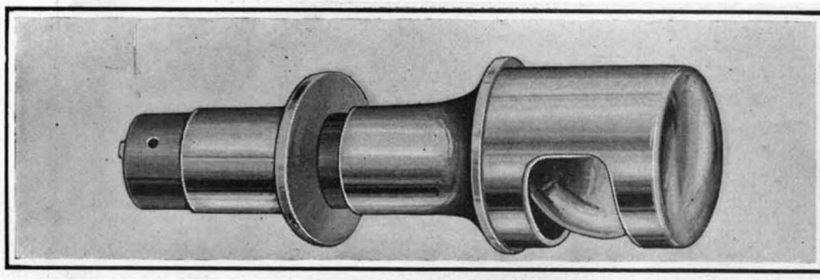
This has an internally geared drum that is operated by a small pinion and a crank handle. The single block of a two-block tackle is combined with the winch. The fall of this tackle is wound on the drum, and this winch gear and tackle give a pull powerful enough to extricate an automobile from a mud hole, ditch, or other inconvenient position. The windlass is made fast to the axle of the automobile, and the double block of the tackle is anchored with stakes that will hold in almost any ground.



Warm wheel grips.

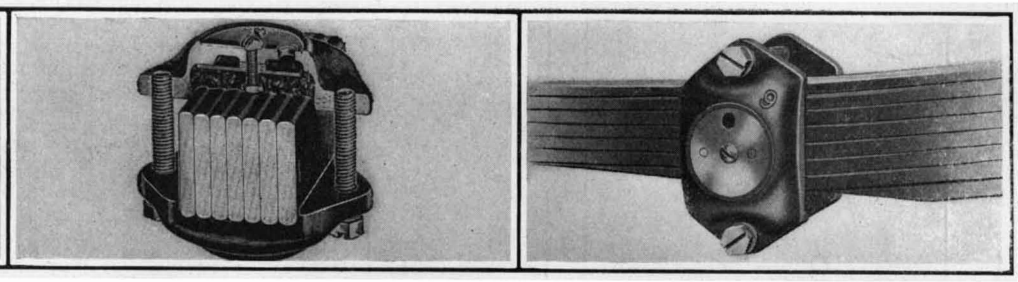
These are electrically heated leather grips that are simply laced upon the steering wheel rim. They are operated either from a battery, lighting system, or generator, and require but little current. They insure warm hands, which helps avoid accidents.

NEW IDEAS IN AUTOMOBILE ACCESSORIES



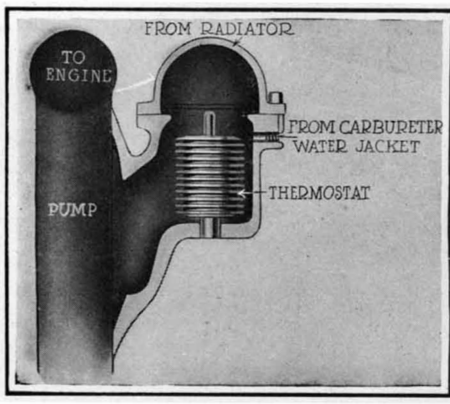
Combination dash and trouble lamp.

A "bayonet" socket in which an easily removed dash lamp may be placed. This furnishes a receptacle for one terminal of a long, flexible cord, into the other end of which the dash lamp may be inserted, thus forming a most convenient trouble lamp that will throw its rays to any desired part of the car. The shade on the dash lamp serves as a reflector for the rays of the trouble lamp.



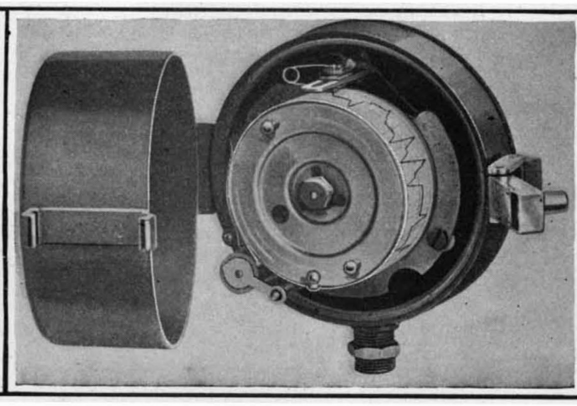
Lubricator for leaf springs.

A box-like device intended to be clamped to the sides of leaf springs to furnish lubrication for the surface. Squares of felt that line the sides of the box and that are pressed against the leaves of the spring serve as oil reservoirs from which the oil creeps by capillary attraction between the constantly moving surfaces of the leaves of the spring. The sectional view shows the construction clearly. The device may be applied with an ordinary screw-driver.



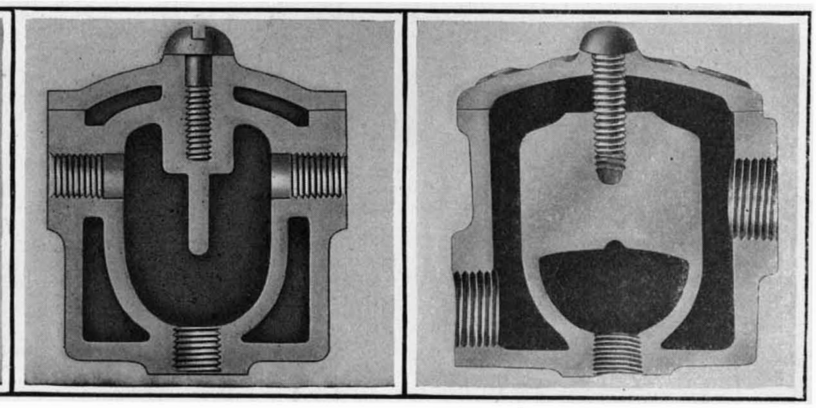
Thermostatic cooling-water regulator.

A valve actuating device controlled by the temperature of the jacket water. When the motor is first started the valve is closed; as the water becomes heated the thermostat expands and allows the passage or more water through the jackets.



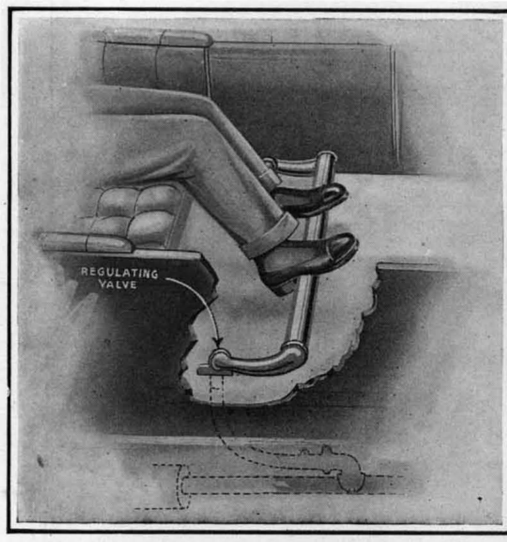
Log book for the motor vehicle.

An instrument which records time, distance, speed, and stops. It is adapted for motor trucks, to provide an absolute check at all times over the vehicle. The instrument has a star type of transmission, and is secured to the front wheel. Special means of attachment under the apparatus makes it tamper-proof.



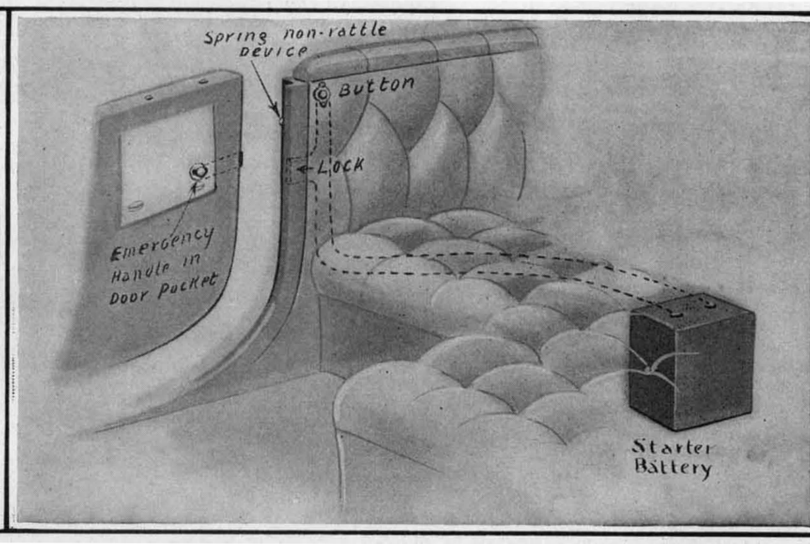
Fuel preheater connected with the exhaust.

A device intended to be installed in the fuel pipe near the carbureter, for preheating the fuel before its entrance to the float chamber. This device consists of an inner chamber, which is jacketed and surrounded by the exhaust gas. Thus the liquid fuel, rather than the atomized mixture, is heated, and the gasoline consequently changes to a gas the instant it is ejected through the needle valve. The two sectional views shown are taken at right angles to each other.



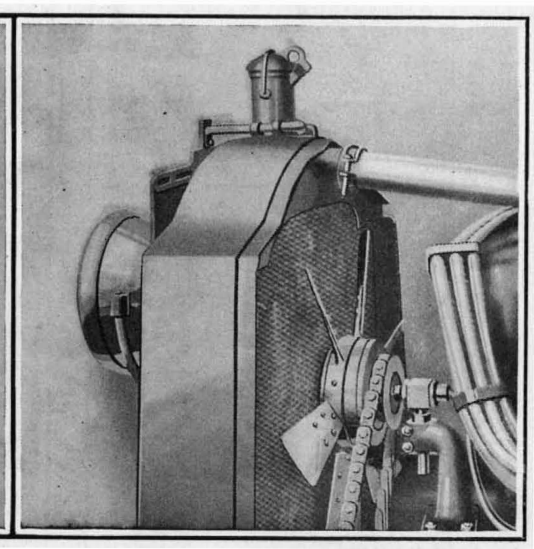
Ingenious foot warmer.

A hollow tube, similar to the foot-rail found in the tonneau of touring cars, is connected, by means of flexible piping, with the exhaust pipe of the car. A valve enables the occupants of the tonneau to admit the hot gases through the foot-rail, or to deflect them through the muffler.



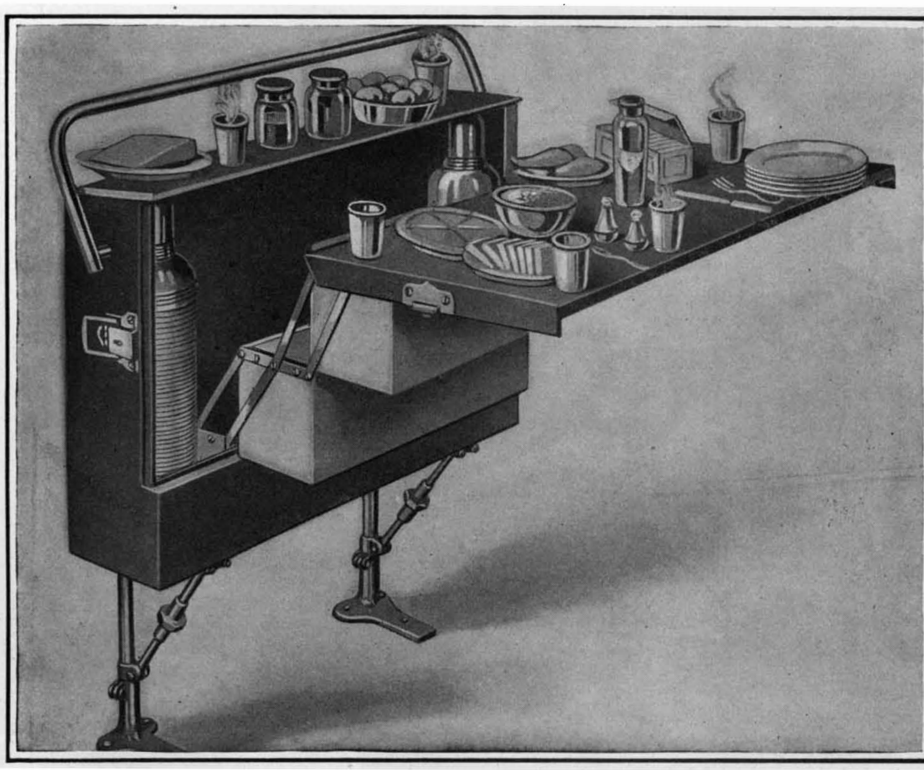
Electric door latch.

One of the recently designed light cars is provided with electric latches at each door. These are controlled by means of magnets excited by the storage battery used in the starting and lighting system of the car. The latches are held in place by springs and are released by the pressure of a button located in the side of the body, close to each door. A handle in the pocket on the door may be used in case of emergency.



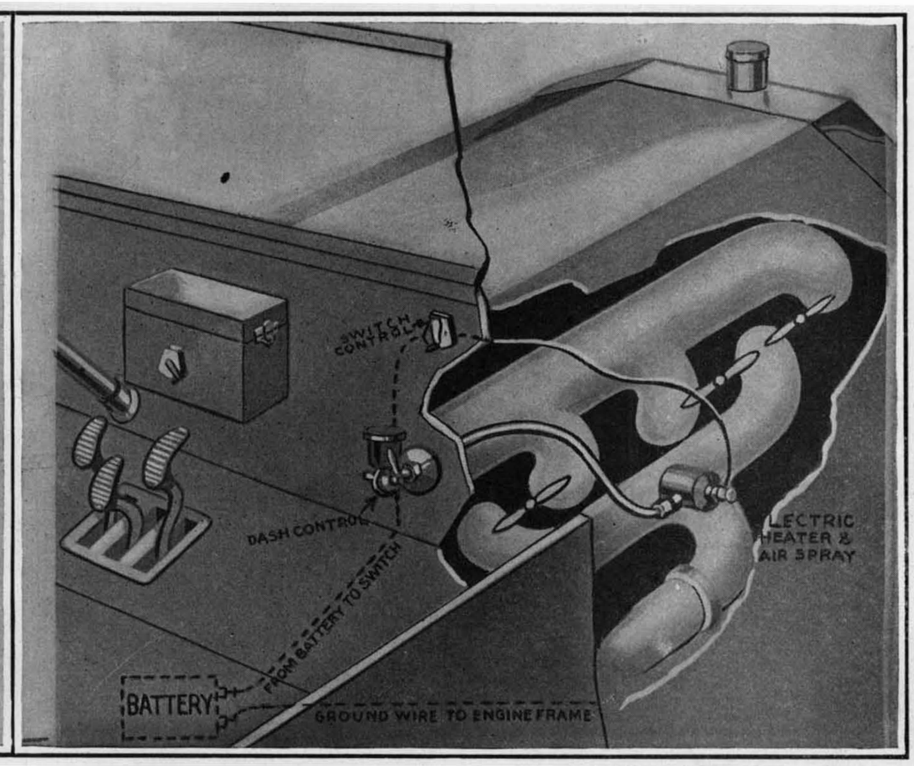
Combined fan and electric generator.

An electric generator combined in the hub of a radiator cooling fan. One portion of the hub serves as a stationary armature, while the revolving fields are carried by the fan. This generates direct current that may be used for charging batteries, for lighting and for ignition.



Motor lunch-case and table.

A compact lunch-case, not much larger than a suit-case, which may be attached to the motor car. When opened the front of the case forms a table on which the lunch may be served. Within the case are a vacuum bottle, and two compartments in which food may be kept ice cold or steaming hot for twenty-four hours. The case holds an ample lunch for six persons with all necessary table appointments.



Electric primer and vaporizer.

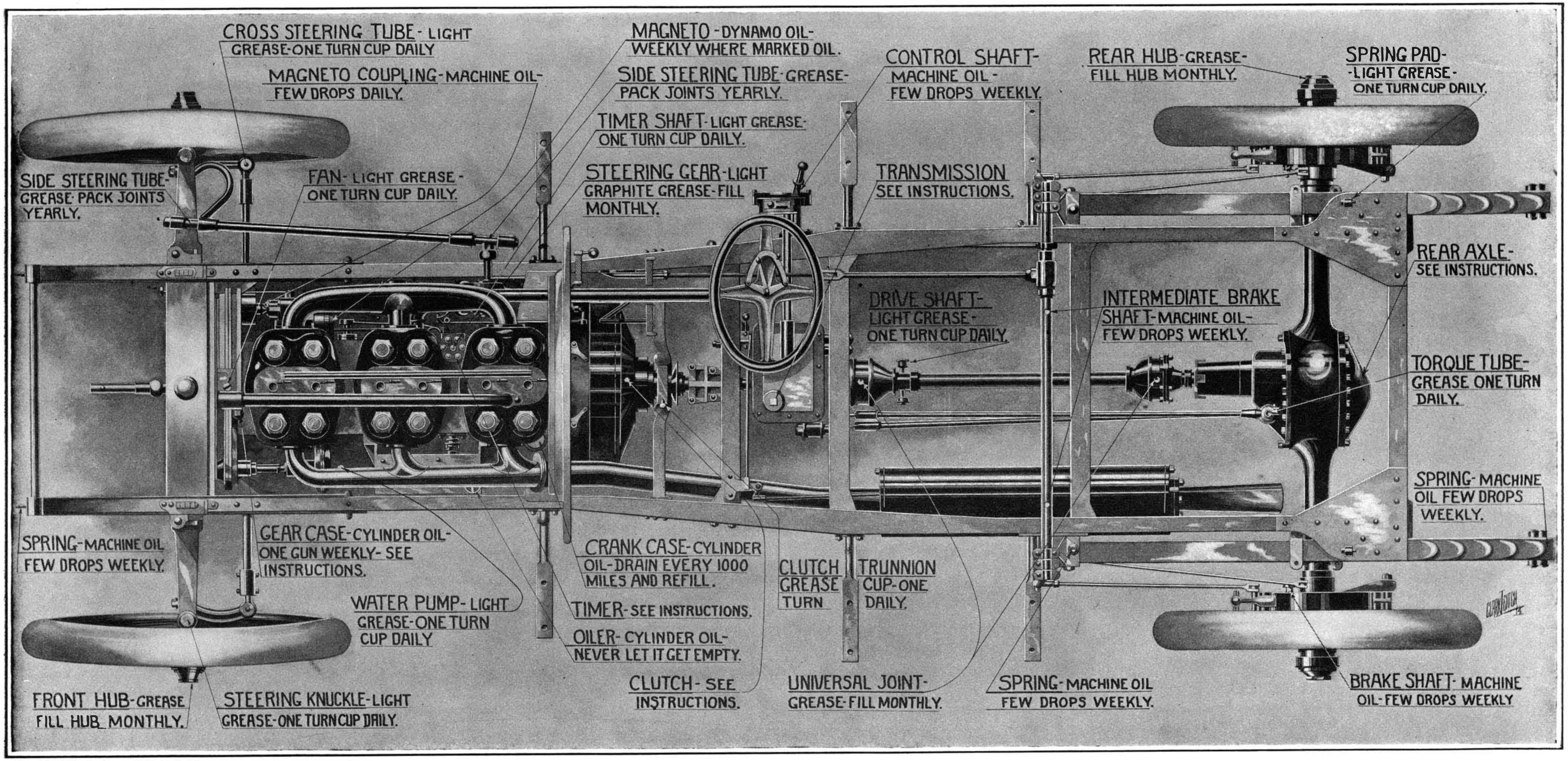
From the priming cup on the dashboard a copper tube leads to a plug connected to a battery and inserted in the intake manifold of the engine. The gasoline from the priming cup passes through the plug, and it is not only sprayed, but actually boiled and vaporized, so that when the engine is cranked over it starts on the first turn over, just as easily on a cold winter morning as on a summer day.

NEW IDEAS IN AUTOMOBILE ACCESSORIES

Chart Illustrating the Proper Lubrication of the Standard Motor Car Chassis

Instructions for the Systematic Oiling of All Important Parts of the Automobile Mechanism

Arranged by Victor W. Page, M. E., Author of "The Modern Gasoline Automobile"



Lubrication of the Motorcar Chassis*

Explanation of Chart

THE plan view of a typical six-cylinder automobile chassis is depicted in the accompanying plate with all important bearing points requiring lubrication outlined. The construction of this chassis follows regular practice and it should be valuable as a guide to the correct lubrication of any car of modern design. While the arrangement of components will vary in the different car types, most of the points indicated will be found in all automobiles and the directions given can be followed to advantage in caring for types other than that shown.

The importance of proper lubrication cannot be impressed too strongly on the minds of the average motorist or chauffeur. Any neglect in this essential means rapid depreciation of the machinery. Attention should be given to all minor points of the chassis periodically as lack of oil at what are usually considered points of minor importance means wear at a multiplicity of joints and noisy operation of the car even if the power plant, gearset, and rear axle are functioning perfectly. In the following instructions, endeavor is made to treat the subject in a concise manner, giving the best kind of lubricant for the various bearing points, reasons for its use, and best methods of application. Where the parts of different design require special grades of oil, this point is noted and proper grade recommended.

Engine Lubrication.

The best grade of oil to be used in the automobile engine depends upon a number of factors, such as power-plant type and condition, lubricating system used, and climatic conditions. The essential point to be observed is to select an oil of sufficient body and fire test to produce a film between all friction surfaces even when the parts become heated. The degree of fluidity must be suited to the system of supplying the oil to the working parts employed. Lighter bodied oil is needed in winter than in summer. The degree of wear between engine parts also governs oil selection to a degree, as a worn engine requires heavier bodied oil than one in which the bearing parts fit more closely together.

The proper oil for the lubricating system shown, which consists of a mechanical force feed oiler at the side of the engine crankcase with exposed pipes, must have a low cold test, that is, it must remain fluid at very low temperatures. In the systems where the oil supply is carried in a sump integral with engine crankcase and without sight feed glasses or exposed pipes, the lubricant need not be of low cold test, because all parts of the engine become heated enough to promote positive circulation of oil soon after the engine starts.

The use of too much oil will result in carbon deposits in cylinders and will be evidenced by clouds of white or gray smoke from the exhaust pipe when the engine is raced. Not enough oil will produce overheating, as will oil that has not enough body. If an engine that has been run for a time is noisy, try a heavier oil if a light bodied oil has been used regularly. Air cooled engines require a heavier bodied oil than water cooled types do because they run hotter.

The following specification for light cylinder oil is recommended by the S. A. E.

Oil must be pure mineral oil, no addition or adulterant of any kind being permitted. The following characteristics are desired:

Specific gravity	28° to 32° Baumé
Flash point, not less than	400° F.
Fire test, not less than	450° F.
Carbon residue, not over	0.50% (½ of 1%)
Viscosity, at 100° F. Saybolt.	300 seconds
Viscosity, at 210° F. Saybolt.	50 seconds

Use only cylinder oils recommended by the car maker or reputable manufacturer of lubricants. For new engines, oil of medium grade in body and clear, pale amber color will be found suitable.

Besides the cylinders and interior parts, there are a number of other points about an engine needing oiling. When the timing gears are housed in a casing distinct from the crankcase care should be taken to keep the supply uniform in this case as well. About one pint of oil will be enough, and cylinder oil of heavy body should be used. The starting crank bracket bearing should be oiled with an oil can, the pump shaft by screwing down the grease cups on the bearings. Mutton tallow and graphite are the best lubricants for this purpose. The fan bearings are usually of the ball type and the fan hub can be packed with light cup grease or vaseline at the beginning of each season.

Electrical Apparatus.

Special care is needed in oiling electrical apparatus. Only light spindle or sewing machine oil should be employed and then in small quantities. The timer, if of the platinum contact point type, needs lubrication only at the bearing points. If a roller contact type, use sewing machine oil sparingly in timer interior. Never use grease or graphite; the latter short-circuits the current, the former gums up and interferes with good contact between roller and segments. Avoid the use of machine or cylinder oil in magneto, generator, and starting motor bearings; use only light oil and a few drops at a time. If these bearings are oiled too frequently, the windings on armature may become oil soaked. This will result in short-circuiting. Avoid the use of oil in magneto contact breaker or distributor; these parts are intended to run without oil.

Clutch Lubrication.

A cone clutch requires lubrication only at three points, these are the spigot bearing, the ball thrust, and the clutch release yoke or rolls. The spigot and ball thrust bearings are usually supplied with light grease through a grease cup. The release yoke and rolls are nearly always oiled by hand, using an oil can and machine oil. The cone clutch leather must be kept pliable with neats-foot or castor oil; never use cylinder oil for this purpose. Oil accumulations on the clutch leather will cause slipping; these must be washed off with kerosene or absorbed with borax or fuller's earth.

Three and five plate clutches operate practically the same as a cone clutch and are intended to be run dry except for the points noted above. Multiple-disk clutches having the driving members faced with asbestos friction fabric are also intended to operate without oil between the friction surfaces.

Multiple-disk clutches using all metal plates are usually inclosed in an oil retaining casing. These are intended to run in an oil bath. Clutches of this pattern are usually lubricated by putting in oil through a filling plug, enough being used to almost touch the center shaft. A good lubricant for most disk clutches is a half and half mixture of light cylinder oil and kerosene. Special lubricant of the proper body for disk clutch oiling may be obtained on the open market.

Change Speed Gear Lubrication.

The most commonly used form of change speed gearing is the sliding gear type. The case is filled about half full with a semi-fluid grease or very heavy bodied steam engine cylinder oil. Avoid heavy greases; these will not properly lubricate the bearings and the revolving gears will cut channels in the grease so that none will get between the teeth. The grease must be light enough to be churned about by the gears. Do not use greases filled with wood fibers or granulated cork. These will cause rapid depreciation of bearings.

Planetary gearsets are seldom used on modern cars. That on the Ford is oiled by the lubricant employed in the engine interior and operates in an oil bath. Where the gearing is carried in a separate case, as in old type cars, use a very light semi-fluid grease, introducing the same with a syringe or oil gun through suitable filling openings normally closed by removable plugs.

Change speed gearing of the positive sliding clutch types with gears always in mesh, or those of the same pattern employing silent chains can be oiled by the same grease used in sliding gearsets. Friction disk forms use grease only at bearing points; no oil should be allowed to accumulate on the driving surfaces.

Rear Axle Lubrication.

The differential gearing of most axle types is housed in a casing that will retain oil. Where bevel gearing is used a grease of about the same grade as that advised for sliding gears may be introduced through a filling hole. Where worm gearing is used the grease should be more fluid; it should be practically a heavy oil, especially if the worm is mounted above the worm gear. This is an important point to observe, as the oil must be lifted by the worm gear teeth to the worm and its supporting bearings.

Many commercial vehicles use chains for driving from a jackshaft to rear wheels revolving on a fixed axle. Chains must be oiled frequently and with care. The points subject to wear are the roll bearing and the link joint rivets. The best method to insure thorough lubricity of these points is to remove the chains from the sprockets, wash them thoroughly in gasoline or kerosene to remove all grit, and then to immerse them in a mixture of molten tallow and graphite. Hang up the chains, allow them to drain off, and then wipe off all surplus lubricant from the chain surface while that member is still hot. This process insures thorough penetration to the bearing points. Oiling the chain surface with an oil can is not sufficient, as this surface oil only collects grit.

All shaft drive cars use one or two universal joints, depending on the method of housing the pinion driving shaft. If this is carried in a torque tube but one joint is used, that at the upper end. Universal joints are usually encased and this casing may be filled with very light grease. On old pattern cars using open joints, leather bags should be made to lace around the joints, these being filled with light grease. These covers serve the dual purpose of protecting the joint from grit and retain the lubricant as well.

Miscellaneous Chassis Points.

Wheel Bearings.—The anti-friction bearings used in both front and rear wheels are intended to be packed with light grease and if the supply in the wheel hubs is renewed several time each season no trouble will be experienced at this point. Axle bearings of the roller type are usually greased by small compression grease cups on the housing, as are torque tube bearings.

Springs.—The main points to lubricate on the suspension members are the spring shackle bolts. These are oiled with machine oil if provided with oil cups and with grease if compression cups are fitted. The spring seats on some rear axles are also fitted with cups to receive lubricants if these members are intended to oscillate on the axle housings. Every season the springs should be taken apart, all rust removed from between the leaves and light grease and graphite smeared between the leaves when the springs are reassembled.

Steering Gear.—The housing at the lower end of the column is usually provided with a filling plug through which cup grease may be introduced until gear housing is full. A grease cup is often provided through which additional lubricant may be introduced. Oil must be squirted in between the column tube and steering post periodically, also on the spark and throttle control members if these pass through the steering post center. The ball joints on drag link and yoke bearings on the tie bar must be kept oiled or greased as the case may be. The compression cups on the steering knuckle bolts must also be screwed down periodically.

Control Members.—The hand levers for shifting gears and applying the emergency brakes and the clutch and brake pedals are located on concentric shafts in some cars and these shaft bearings must be oiled by a hand oil can in most cases. The small rod end pins on brake rods and bearings on the axle supporting the brake control shafts also demand frequent attention with the hand oil can.

Draining Off Used Lubricant.—As any oil or grease is used, it gradually depreciates in value as a lubricant. The oil used in constant level splash systems of engine lubrication becomes impregnated with carbonaceous matter and metal dust due to attrition of the bearings and other internal parts. That used in gearsets may contain small metal particles chipped off of the gears when these are clashed in shifting and the oil in the differential housing also becomes dirty as used. In other words, oil may "wear out" and become unsuitable as a lubricant when used continuously. Most engine builders recommend thoroughly draining out the engine crankcase every 1,000 miles, washing out all sediment with kerosene, and replenishing the supply with clean, new oil. The smallest automobile engine crankcase will need about a gallon to refill, those of larger engines may require two or three gallons.

A multiple-disk clutch case should be cleaned out frequently, usually as often as the engine receives attention. Gearboxes and rear axles should be washed out every 2,000 miles and new clean lubricant used in refilling. Where grease cups are employed the new grease forces out the old lubricant, as the cup is screwed down so a constant supply of clean grease is insured. Similarly, those points lubricated with fluid oils are supplied with clean oil from the hand oil can as the used oil leaks out gradually from between the surfaces. Keep all surfaces exposed to the dust wiped clean of lubricant, as this serves no useful purpose, merely attracting road grit. Keep all oil and grease from the tires, rubber hose connections of the cooling system and insulation of the ignition wires, because lubricants have a soluble action on rubber or compounds containing that material.

* Copyright, 1914, by the Norman W. Henley Pub. Co.

The Zodiacal Light.—According to Fessenkoff, it is impossible, in view of the discordances existing between the facts announced by different observers (Bayldon, Marchand, Tupman) to fix in any precise manner the position of the band of zodiacal light. New observations are necessary and Birkeland proposes to pursue them for a period of three years at Natal and elsewhere, including Uganda. His object is to test his hypothesis relative to the emission of radiant matter and electrons by the sun. In his opinion these corpuscles group themselves around the sun's magnetic equator.

War Experiences of an Air Scout—II*

The Patrol of the Sky

By Frederick C. Hild, American Volunteer With the French Aviation Corps

THE next morning a bugle aroused us at 6:30, and after a hasty toilet in a cold stream that runs close by I was ready for roll call. This roll call is held at 7 o'clock every morning, and as absence from this means four days in jail I always managed to be present. Saluting superior officers was another hardship, and after several "call-downs" I was able finally to salute every officer I met as well as the two-year experienced and trained soldier.

After roll call we went to breakfast. This consisted of a cup of black coffee and hard dry bread. How the French government expects us to fly on such fare is beyond me. I went to the home of some peasants in the vicinity, and for a few cents I obtained a large bowl of hot chocolate, with bread and butter. This I did every morning.

I was not given an opportunity to fly for several days. I was informed that I must wait until a new machine was completed. It is a rule that all new arrivals must make their first flight on a machine of only 50 horsepower. I found there was an oversupply of French mechanicians, there being about five to each machine. I wondered why there were so many until I saw the way they worked, and then I wondered no more. One good American mechanic can do more work in a day than five of them in a week.

The First Test in the Air.

My friend, Fileux, who was among the pilots, and I passed our first tests successfully, but the man (Corporal Delmas) who was tried out after us, wrecked the machine, which was a 50 horse-power Gnome-motored, Blériot monoplane, and caused us further delay.

I was beginning to get disgusted with the slowness of the French military system; therefore, I besought Capt. Duperron, through an interpreter, for some action, and was henceforth transferred to the "Rep" monoplane, a machine that easily makes 90 miles an hour. The Rep monoplane, equipped with an 80 horse-power Gnome motor, is quite a heavy apparatus, constructed mostly of steel, and in workmanship and materials it represents the best French aeronautical construction that I have seen.

A Member of the "Rep" School.

My opportunity to fly came the next day, and for the first time I enjoyed a flight of 30 minutes, which took me 2,000 meters (6,500 feet) high and gave me an opportunity to see the country about me. Tours is indeed a beautiful city. The day being a clear one, I could see the country for miles about; chateaux showed themselves here and there, and I should have liked to continue my flight, but, being permitted to fly for only a half hour, I was obliged to come down.

My friend, Fileux, seeing my success, also inquired of the captain for permission to be transferred to the Rep monoplane; and sad to say his first venture wound up disastrously, owing, perhaps, to his getting excited by the tremendous speed. He pulled back the elevating lever several inches, to rise, when he should have pulled it back about half an inch, and as a result, the machine shot straight up into the air for about thirty feet and then fell upon its side and nose like a wounded bird, completely smashing the apparatus, and, poor fellow, he is in the hospital, where he will be laid up for about a month, his right eye being hurt and his knees badly injured.

A Collision Narrowly Averted.

The following day, not having a machine to fly, and seeing a new Blériot monoplane flying, I requested the captain to let me fly it. I received permission, but was told by the captain that, as I was now in the Rep school I could fly that machine only, and that, therefore, this would be my last flight on the Blériot. I flew for 45 minutes and enjoyed it immensely, though I narrowly escaped death by collision in the air with a Nieuport monoplane. My machine was flying horizontally at an altitude of about 1,500 feet, when directly above me a pilot in a Nieuport was spiraling from a height of 5,000 feet, and coming directly toward me. I tried to steer out of its path, but he kept on coming toward me, and for the moment it appeared impossible to avert a collision. I attempted to dive, but had it not been for the fact that he peered out of the machine in my direction, nothing in the world would have saved me, since the speed of his machine doubled that of mine, and it was only by his immediate jerking of the elevating control toward him that he saved the situation. His machine was so close that the tail of his machine seemed to graze that of my machine, and the sudden rush of disturbed air was so violent that I had the greatest difficulty in keeping my apparatus from capsizing.

I remember only one other incident in my four years of flying where I was so close to death; this occurred the day of the baby parade at Asbury Park a year ago; when, with my apparatus directly over the parade, my motor stopped, and I crashed through the branches of a large tree near the baseball park, from which point I had started my flight.

The next morning a new arrival to the Second Aviation Reserve at Tours did the same to the Blériot monoplane I had flown the day before as my friend Fileux had done. This made the third machine I had flown at Tours that was completely demolished the next day. This poor chap, though unhurt, is now serving a thirty-day term in jail, as it was learned that he had never been in a machine before in his life.

Qualifying for Pilot.

Two days later, Friday, October 9th, proved an eventful day for me. A new 80 horse-power Rep monoplane had arrived, and I was given permission to fly it. I did so for twenty minutes, and then I was given permission to qualify for my military brevet. The recording barometer was secured and fastened to the machine by the mechanics, but after flying for five minutes it worked loose, and I was forced to descend for a fresh start—an example of the work done by the French mechanics. This time it was fastened more securely. I arose to a height of 2,500 meters (8,200 feet) in twenty minutes, and then straightened out my machine to remain there for one hour or more; but alas! after flying for thirty minutes at this altitude, the barometer refused to operate, and I had to descend.

I made a fresh start at three o'clock in the afternoon. This time I fastened the barograph myself, by a cord around my neck, the barograph resting against my chest, to which I had fastened a mirror in order to note its operation while in flight. A small aneroid, a stationary part of the machine, capable of registering 3,000 meters, acted as a guide when once I attained the height of 2,000 meters.

I bundled up good and warm with safety helmet, goggles, sweater, leather coat, and gloves. I flew for one hour and forty-five minutes, one hour and fifteen minutes of this at the height of 2,200 meters (7,200 feet). The barometer worked perfectly, and I had flown all over the neighboring country, which consisted of large dense woods, rivers Share and Loire, large cities and small towns, and I certainly enjoyed my stay in the air at this altitude, although it was terribly cold, and I was really glad to descend once again to Mother Earth. The recording barometer having worked satisfactorily, I was given my military license by the military officials, who congratulated me upon being the first and only American licensed aviator to fulfill the test. I now await the arrival of the brevet from the Minister of War and the Director of Aeronautics, both of whose approvals I must have before it is issued, since upon its receipt I am ready to be sent to the front. I was informed by the captain that he had received instructions from headquarters that four licensed Rep monoplane pilots were wanted in a few days to pilot machines to the front; so I was rather pleased to have obtained my license, as I was tired of wasting valuable time when I could be accomplishing something and be of some use to France.

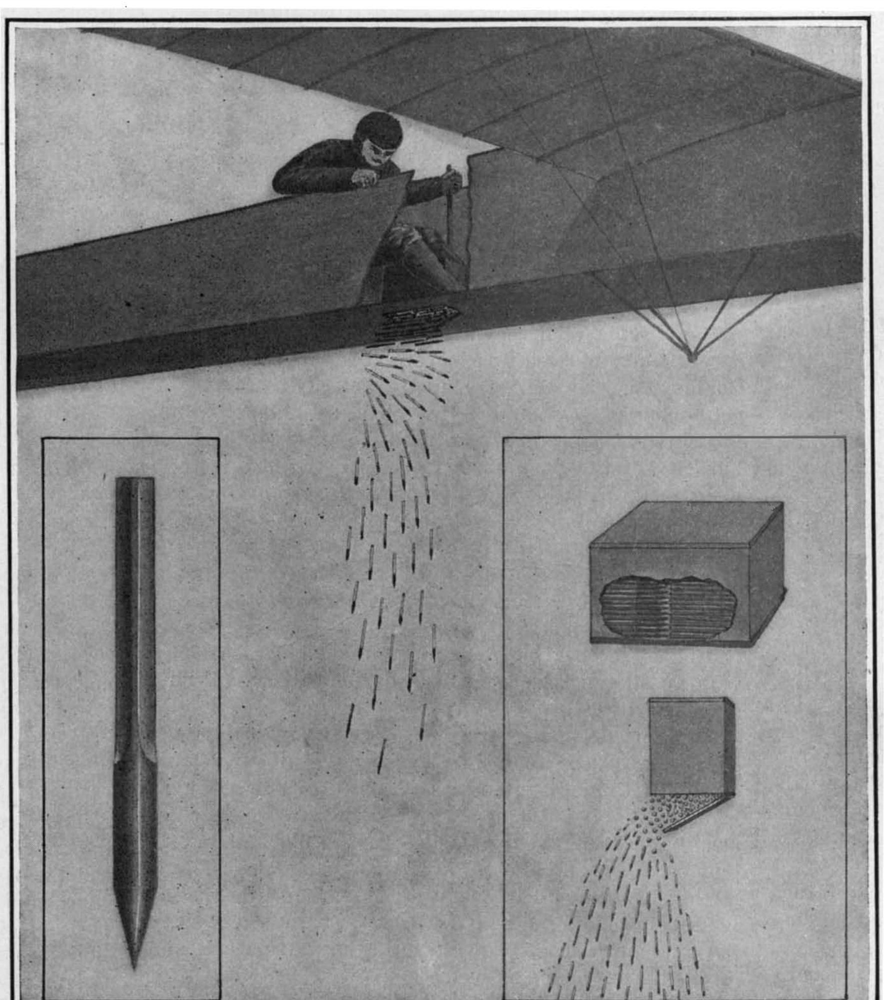
Machines Discarded by the French Government.

Three days after having qualified for my military brevet, an important order was issued by the Director of Aeronautics, which affected a great many pilots and demonstrated the inefficiency of certain apparatus. The order ran as follows:

In future there shall be no more Blériot, Rep, Nieuport, or Deperdussin monoplanes used by the French government, and all those pilots learning or now operating any of these machines must immediately change to either of the following apparatus: Morane-Saulner monoplane, Henry Farman biplane, Maurice Farman biplane, Caudron biplane, or the Voissan biplane.

I immediately changed to the Morane-Saulner monoplane, a smaller machine in comparison to the Rep monoplane, but con-

(Concluded on page 38.)



How steel darts are dropped from an aeroplane.

Insert on the left shows a dart about half size; on the right, the box from which they are discharged.

American Automobile Coachwork

Criticism of Domestic and Foreign Car Bodies

By John Jay Ide

THE bodies of American motor cars produced for the season of 1914 exhibited a noteworthy advance over those of the preceding season. A certain number of manufacturers realized that they could learn something from foreign design with the result that not a few cars boasted hoods tapering into the cowls, giving the proud designer the opportunity of calling the child of his brain "a true streamline production." Even where no transition between hood and dash was attempted, that typical American institution—the windshield with massive brass stay rods, which rendered the engine so difficult of access—was in many cases replaced by one fastened securely enough to the cowl to need no external bracing. In a very few cases the one-man top fastening onto the windshield was adopted, thus rendering unnecessary another eyesore: the straps connecting the front of the top with the frame or mudguards as the case might be.

For 1915 these tendencies find wider expression, and it is now the exception rather than the rule to see a new model offending in the above respects. A few makers have copied a certain Belgian car in supplying pointed radiators. A greater number have followed the lead of a certain French "marque" of racing fame in rounding off the radiator top, thus eliminating the hard edge.

In most of the cheaper cars sidelights have ceased to exist on the claim that they interfere with the streamline effect. A dimmer attachment in the headlamps is substituted for them. Most of the higher priced cars, however, retain sidelights either in combination with the headlights or in their accustomed place at the dash.

Many makers advertise "crowned" mudguards; a few have gone further and have adopted domed guards. The latter is certainly the final type, but stress should be laid upon the desirability of having the valance and mudguard in one piece. This not only eliminates a possible source of squeaking, but greatly improves the appearance of the car.

Most of our designers have not yet learned to make the rear fenders follow the curve of the wheels. Beginning too near the tire on account of the presence of the door, the mudguard steadily diverges therefrom until at its rear end it is often as much as 9 inches away. It may be urged that this is done to allow for depression caused by weighty passengers in the rear seat. As a matter of fact the depression is barely perceptible in the most heavily laden cars owing to the stiffness of the springs.

Both front and rear fenders would be much more efficient if they were brought closer to their respective wheels. After all, only sufficient space is needed to allow for the spring compression on the wheel's striking an obstacle. There is much to be said in this respect for the mudguards attached to the stub-axles and following the vertical movements of the wheels. These have been tried both here and abroad, but difficulty has been experienced in attaching them securely. Surely this can be overcome.

As remarked above, one-man tops have become general, so that entrance to the front seats is no longer blocked by the bows. The obstruction caused by the bows was one of the greatest defects of the old-fashioned top, and it is astonishing that the one-man type was not adopted here before 1914, as it has been used in England a number of years. Another inconvenience has also happily been removed. That was the gap between the top of the windshield and the front of the top, often just large enough to allow the rain to drift in and wet the occupants.

A number of makers now inclose the top completely when down, not even allowing the bows to peep out of their housing. This is one step toward the incorporation of the top in the body, credit for which must be given to a noted Berlin coachmaker who exhibited a remarkable body at the European shows in November, 1912. As shown in Fig. 1 the lines of the top casing are very agreeably led off into the rear panel. When out of use the top is completely boxed in by three detachable sections. The general appearance is very pleasing indeed, but it is difficult to imagine anything not superior to the ordinary top when folded down.

Apart from the top casing the body has many points of originality. The sidelights are placed on the mudguards, where they fulfill their true function of indicating the real width of the vehicle. The divided rear seats are of the adjustable Pullman type. Behind the front seats is a cowl protecting a cupboard with several drawers. It will be seen that no upholstery protrudes above the body sides. The round hole adjacent to the levers is the gauze covered horn orifice. Except for the external levers and the mudguards this body is still in advance of current touring car design.

Fig. 2 represents the latest model of the same firm. As in the previous body one can hardly detect the rear end of the hood. When it is desired to light the headlamps the front sections are removed and clipped upon the rear portions.

A German sporting model is shown in Fig. 3. Rather than mold the bonnet to suit the body the designer has forced the latter into an ugly form. The windshield is interesting as the glass of the stationary portion is cut to fit the bonnet curve, there being no filler board. The external exhaust trunk, elementary mudguards, disk wheels and pointed radiator are in keeping with the character of the design.

The French berline in Fig. 4 has an overall height of slightly less than six feet. This body might be studied with advantage by the makers of some of our ponderous eight-foot chariots. Although of the single-compartment type it has a separate entrance for the front seats, a solution not without certain advantages. Sufficient headroom is obtained for the rear seats by sinking the floor below the chassis level.

To England must go the credit for developing the cabriolet, an example of which

(Concluded on page 40.)

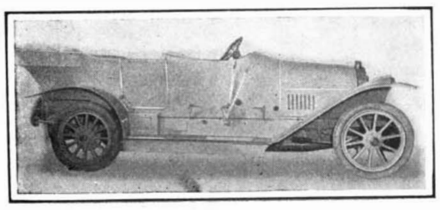


Fig. 1.—Top snugly housed.

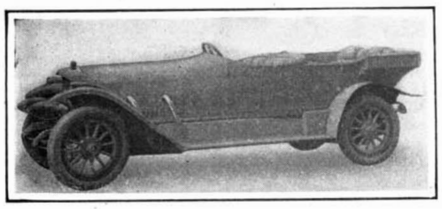


Fig. 2.—Streamline headlights.

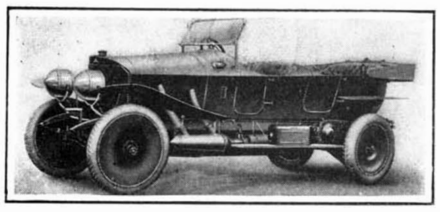


Fig. 3.—Note ungraceful lines.

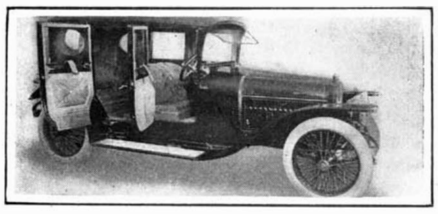


Fig. 4.—A French berline.

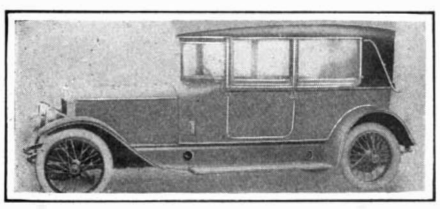


Fig. 5.—An English cabriolet.

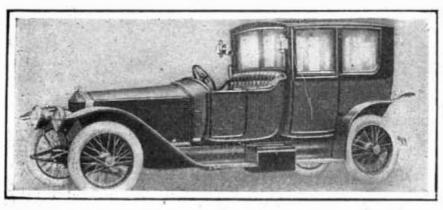


Fig. 6.—English town car.

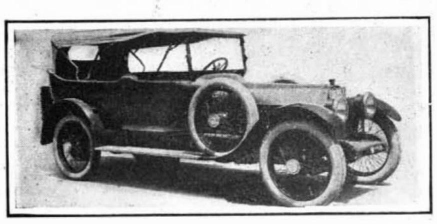


Fig. 7.—American touring body.

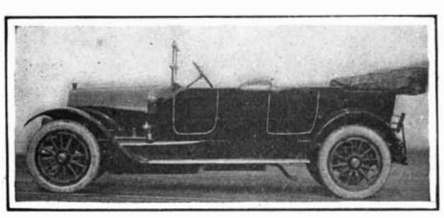


Fig. 8.—Rather inelegant design.

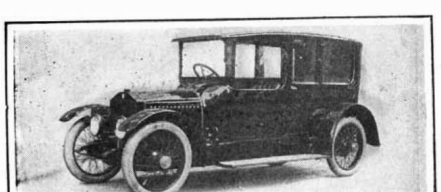


Fig. 9.—Very harmonious design.

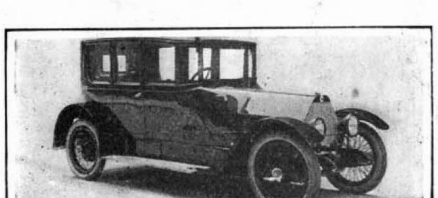


Fig. 10.—Clean cut berline.

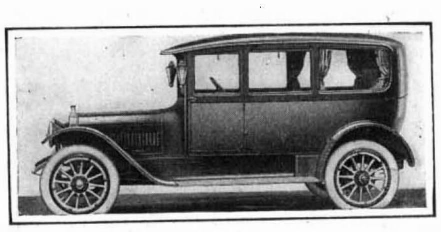


Fig. 11.—A novel sedan.

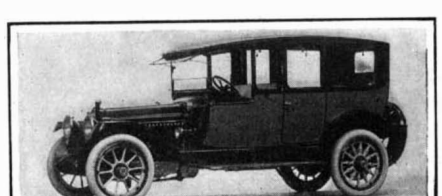


Fig. 12.—A pleasing limousine.

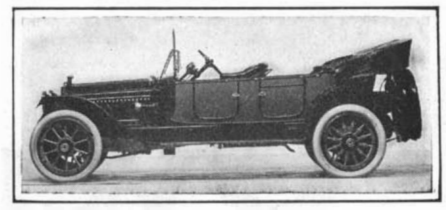


Fig. 13.—Shows broken lines.

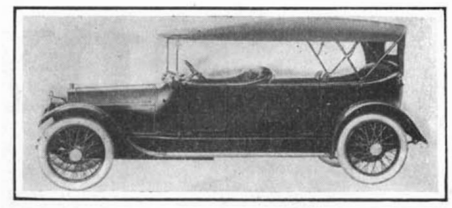


Fig. 14.—Symmetrical touring body.

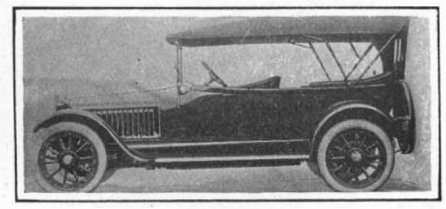


Fig. 15.—Boat type body.

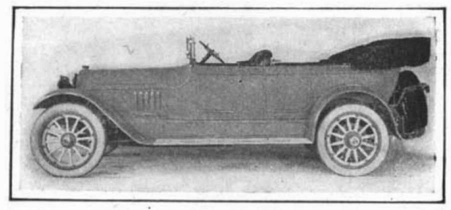


Fig. 16.—Too many moldings.

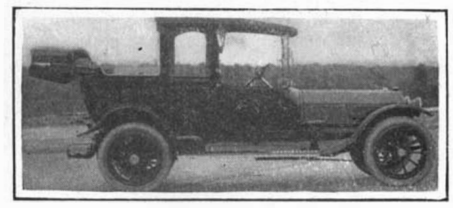


Fig. 17.—An unsuccessful design.

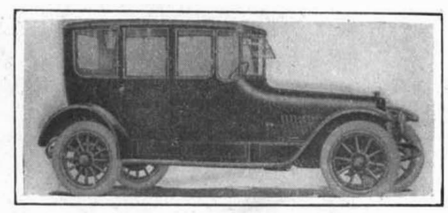


Fig. 18.—A fine sedan.

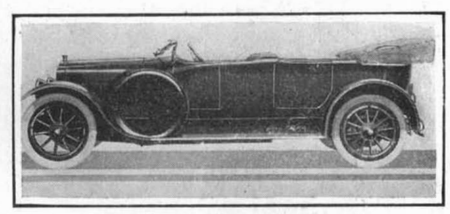


Fig. 19.—Handsome American tourist.

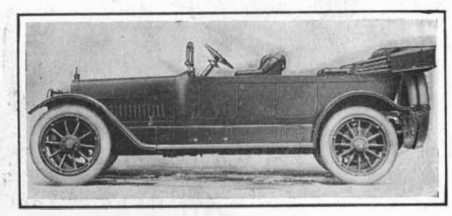


Fig. 20.—Has too low a side.

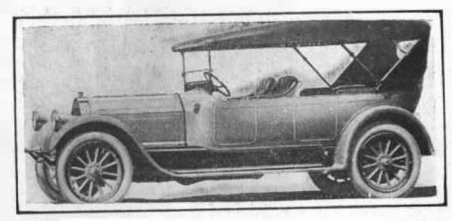


Fig. 21.—Rather low-sided.

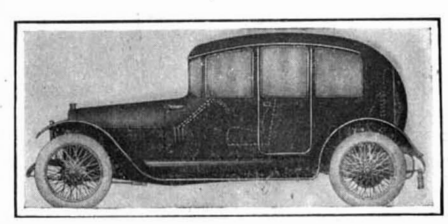


Fig. 22.—A sedan design of 1912.

The Heavens in January

Weighing and Measuring a Star 200 Light Years Distant from the Earth

By Henry Norris Russell, Ph.D.

THE distances of many of the stars are now fairly well known; their real brightness compared with that of the Sun may frequently be calculated; we know the densities of about ninety stars and the masses of a rather smaller number. But there are very few cases in which the actual size of a star—its diameter in miles—can be determined, and, therefore, a new instance of the sort well deserves discussion here.

The star in question, known as RX Herculis, is of the seventh magnitude and quite invisible to the unaided eye. As its designation indicates to the initiated, it is variable in brightness, and the fact that we can determine its actual size adds to the discerning mind the information that the variability must be due to eclipse and that it must have been observed with the spectroscope.

Attention was first called to this star when it was found that it lost about 40 per cent of its light at intervals of 21 hours 20 minutes and 34 seconds, remaining constant in brightness for all but about 5 hours of this interval. This behavior showed at once that the loss of light must be due to an eclipse by some attendant body, as in so many other cases.

Spectroscopic observations by Prof. Frost at the Yerkes observatory showed that the lines in the spectrum became double in the interval between eclipses, and thus proved that the companion as well as the principal star was bright, so that their spectra appeared simultaneously when one was rushing toward us after it had been eclipsed, and the other receding. Long series of accurate measures of the brightness of this star have been made at Harvard by the late Prof. Wendell, and at Princeton by Dr. Shapley (now of the Mount Wilson staff), by whom the calculations here described have been carried out.

These two sets of measures agree perfectly, and show that, outside the eclipses, there is not the least variation in light. Successive eclipses, however, are slightly unequal in magnitude, the maximum observation being alternately 40.8 and 35.7 per cent of the light at maximum. This small difference is demonstrated beyond question by the observations. Its explanation is fairly obvious. The two stars, which revolve around one another, are slightly unequal in brightness. One gives off a little more light per square inch than the other, and so when the former is eclipsed a little more light is lost than in the opposite case. As the stars circle about their common center of gravity, each in turn partially eclipses the other, and the observed situation follows. The actual period of revolution must then be double that between eclipses, or 1 day 18 hours 41 minutes 8.79 seconds, according to Dr. Shapley. As the time of the middle of eclipse can be determined within a very few minutes, and it has been under observation for fourteen years, or nearly 3,000 revolutions of the system, it is clear that this value can be at most a couple of hundredths of a second out of the way.

The orbits in which these two stars move about their center of gravity must be practically circular; for the shallower eclipses come just half way between the deeper ones and last equally long, and if the orbit was eccentric this could not be the case.

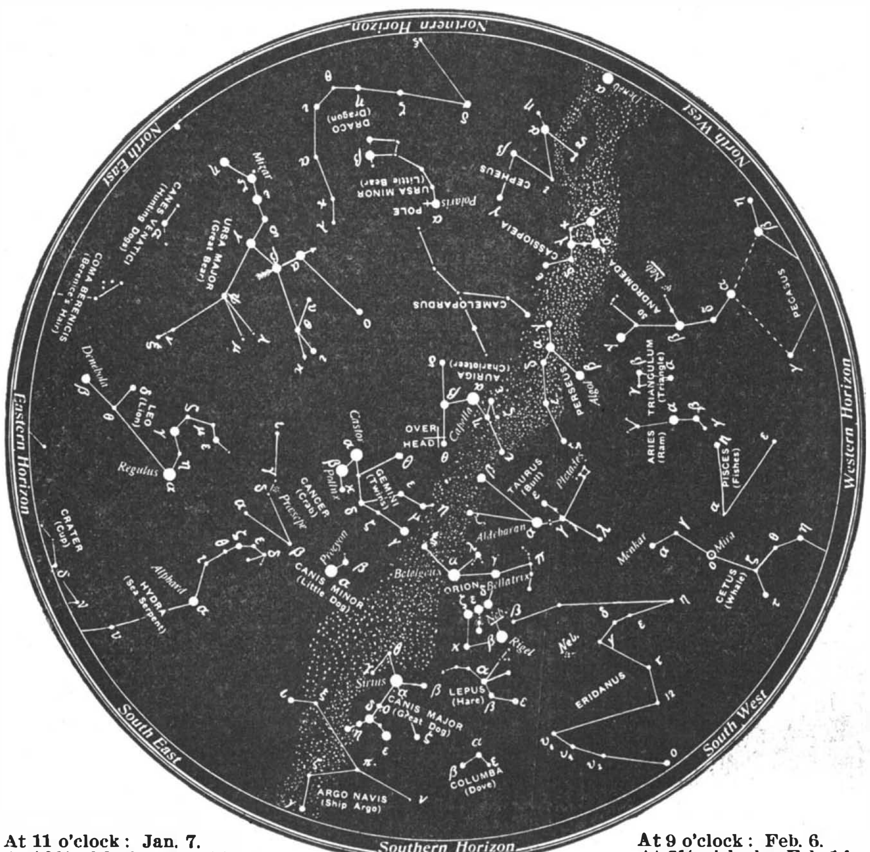
So much has now been found out about this system by very simple reasoning that it is not surprising that a great deal more can be discovered by calculation based on the photometric observations (which give the relative sizes and brightness of the stars) and the spectroscopic data (which give the actual size of the orbit, and hence of the stars, in miles). We may, therefore, pass to Dr. Shapley's summary of his conclusions, which is substantially as follows:

The system of RX Herculis consists of two stars of equal mass and nearly equal brightness, which revolve about their common center of gravity in circular orbits of equal size at distances of 1,620,000 miles on opposite sides of the center, or 3,240,000 miles from one another, completing a revolution in 1 day 18 hours 41 minutes, as aforesaid.

The plane of this orbit makes an angle of only 4 degrees with the line of sight from us to the star, so that each star eclipses the other once in every revolution. The larger star, 1,300,000 miles in diameter, does not shine quite so brightly per square mile as the smaller, so that the latter, though but 1,170,000 miles in diameter, gives out eleven twelfths as much light as the other. When the smaller star goes behind the larger only a thin crescent of about one seventh the width of the whole disk remains in sight. This gives the principal (deeper) eclipse. When the small star comes in front of the larger, we get the secondary and shallower eclipse.

The mass of each star is 89 per cent of that of the Sun (unusually small for a white star like this), and the density of the larger one is one quarter, and that of the smaller one third of the Sun's density.

If the stars give off as much light per square mile as does the Sun their distance from us must be such that light would take 200 years to travel it. But the spectrum of the stars closely resembles that of Sirius or Vega, and it is very probable that stars of this sort are much hotter (at least on the surface) than the Sun, and shine far more brightly—giving out from



At 11 o'clock: Jan. 7.
At 10½ o'clock: Jan. 14.
At 10 o'clock: Jan. 22.
At 9½ o'clock: January 29.
At 9 o'clock: Feb. 6.
At 8½ o'clock: Feb. 14.
At 8 o'clock: Feb. 21.

NIGHT SKY: JANUARY AND FEBRUARY

six to ten times as much light per square mile. On this basis, therefore, the distance of the system may be estimated as 500 light years (or thirty million times the distance of the Sun), and the light emission of the pair as fully thirty times that of the center of our system. If this be true the eclipses recently observed actually took place long before Columbus discovered the New World, and more than ten thousand other eclipses of each star by the other have happened since, and are, so to speak, on their way to us—the light which will announce them being still far in the depths of interstellar space.

It is really amazing that, by means of observations which, if a full account was kept of the time taken, would aggregate less than a month's work by one observer, so much information about the nature of a star at so immense a distance can be obtained.

The Heavens.

The southern sky now displays its full splendor. Orion marches proudly across the meridian, confronting the Bull with upraised arms, while the Great and Little Dogs follow their master, and we may, if we will, imagine that the Little Hare and the Dove are escaping for dear life. But we cannot carry our mythological picture much farther without getting into a helpless jumble of ships and sea serpents and crabs and twin babies; so it may be well to return from the constellations to the stars.

In the dull southwestern sky we may note our near neighbors. δ and ε Eridani and τ Ceti, and the famous variable Omicron Ceti (Mira) now rapidly rising toward maximum. Farther to the right and west of north one may, on the brilliant nights of winter, see at their best the nebula of Andromeda and the great star cluster in Perseus (between this constellation and Cassiopeia) and then facing about, compare these with Praesepe in Cancer—a cluster which, unlike that in Perseus, is resolvable into its component stars in a field-glass.

From the very appearance of this cluster one would judge that it was nearer than the other, and this is probably true—though if Schwarzschild's estimate of 500 light years for its distance be correct, as seems very likely, it is hardly what even an astronomer would ordinarily call a neighboring object. Kapteyn, in the case of the Perseus cluster, concludes that it is probably 1,600 light years off at the least, and perhaps very much farther.

As for the Andromeda nebula, hardly anyone would dare even to guess at its distance, but as its spectrum resembles that of a star cluster, and no separate stars can be seen, even with the greatest telescopes, it may be vastly more distant still. Turning back to the east, we find Leo well above the horizon, and Ursa Major coming up on the northeast; and the familiar constellations about the pole complete our survey.

The Planets.

Mercury is practically invisible at the beginning of the year, but comes out into the evening sky, and by the end of January is well visible, setting at 6:30 P. M. By the end of the month he is close to Jupiter, and the two form a pretty pair, Jupiter appearing about twice as bright as Mercury.

Venus is morning star, and at her greatest brilliancy as the year opens—twelve times brighter than Jupiter. She rises at 4 A. M. or a little after all through the month, and is the glory of the morning sky.

Mars, having just passed conjunction with the Sun, is theoretically a morning star and practically invisible.

Jupiter is evening star in Capricornus and visible now only in the early evening. Saturn is in Gemini, just past opposition and a splendid object both to the eye and telescope. He is so bright that he quite changes the appearance of even the brilliant region of the heavens through which he is passing.

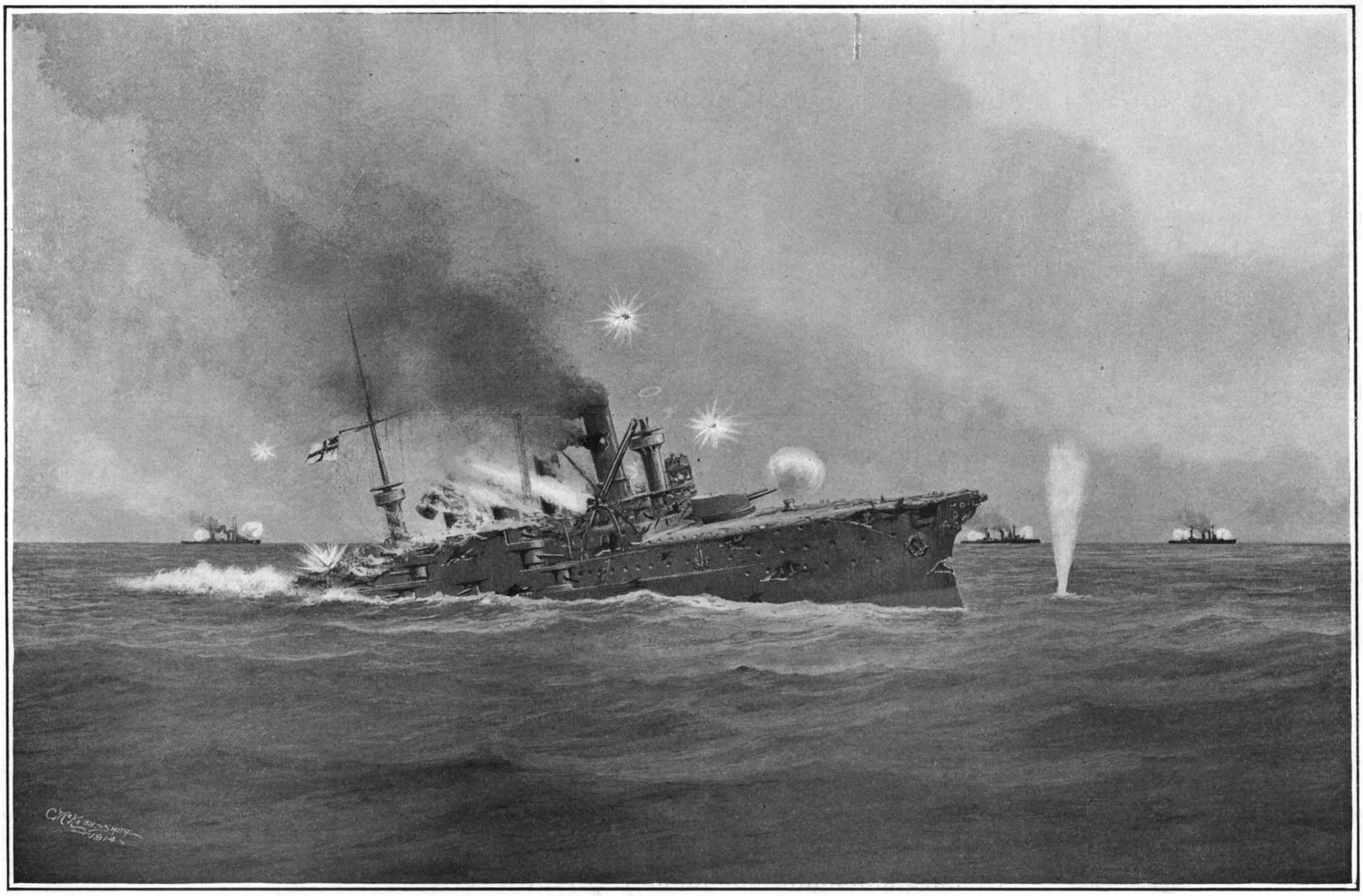
Uranus is so low in the west at sundown as to be unobservable. Neptune, on the other hand, is in opposition on the 19th, and favorably placed. On December 31st his right ascension is 8 hours 6 minutes 46 seconds and his declination 19 degrees 52 minutes north. On February 1st these co-ordinates have become 8 hours 3 minutes 5 seconds, 20 degrees 4 minutes north. This puts him about 8 degrees west of Praesepe and 2 degrees north of the fine triple star ζ Cancri—where the observer who has a three-inch telescope and a star-chart, or the patience to make one for himself, may find him.

The Moon is full at 7 A. M. on the 1st, in her last quarter at 4 P. M. on the 8th, new at 10 A. M. on the 15th, in her first quarter at 1 A. M. on the 23rd, and full again at 11 P. M. on the 30th. She is nearest the Earth on the 12th, and farthest away on the 24th. She passes near Venus on the 12th, Mars on the 14th, Mercury on the 15th, Uranus on the 16th, Jupiter on the 17th, Saturn on the 27th, and Neptune on the 30th.

Princeton University Observatory.

Shipping Eggs by Parcel Post

THIS is a subject in which both the Post Office Department and the Department of Agriculture have, of late, been greatly interested. During the period October, 1913-February, 1914, the Office of Markets carried out a thorough test, consisting of no less than 466 shipments, aggregating 761 dozen eggs, sent over various distances, under various conditions, and in various types of containers. Some of the longest shipments were between Washington and Minneapolis and between Washington and the Rocky Mountains. The total breakage was 327 eggs, of which only 209 were broken beyond use, and of these 91 were broken because the parcels containing them were not handled in accordance with postal regulations. Subtracting these, the loss was less than 1.3 per cent.



The "Scharnhorst" going down at the close of the engagement, off the Falkland Islands, with Admiral von Spee's flag at the main yard.

The Sinking of the German Pacific Squadron

Superior Speed and the Long-Range Guns Win a Running Fight

By piecing together the many cabled accounts of the late British-German cruiser action off the Falkland Islands in the South Atlantic, we are able to gather a fairly accurate impression of that highly dramatic sea fight. The encounter marked the successful end of a search for the German ships undertaken by Vice-Admiral Sturdee with the battle-cruisers "Invincible" and "Inflexible" and a group of five smaller vessels.

As will be seen from the enumeration given below, the British squadron possessed a superiority in armor-piercing guns and armor as overwhelming as that which enabled Von Spee to crush the British squadron under Cradock a few weeks before.

The British fleet consisted of the battle-cruisers "Invincible" and "Inflexible," the armored cruisers "Carnarvon," "Cornwall" and "Kent," and the scout-cruisers "Bristol" and "Glasgow." In the German fleet were the armored cruisers "Scharnhorst" and "Gneisenau," the protected cruiser "Leipzig," and the two fast scout-cruisers "Nurnberg" and "Dresden."

When last heard from, Von Spee's squadron, after coaling at Valparaiso, had steamed south. Apparently his objective was the British coaling station at Port Stanley in the Falkland Islands; and a rumor (to which too much credence should not be given) has it that the converted cruiser "Prinz Eitel Friederich," with troops on board for the occupation of the station, accompanied the squadron.

Be that as it may, on the morning of December 8th the "Canopus," an old battleship with 6-inch armor and 35-caliber guns, and the British armored cruisers and scouts, which were cruising outside the land-locked bay on which Port Stanley is located, saw the German squadron lifting above the horizon. The two British battle-cruisers were inside, coaling, and according to dispatches were not visible to Von Spee. To the German admiral it looked like an even fight, for, although it was six ships to five, there was no vessel in the British force that could match the "Scharnhorst" and "Gneisenau." So down he drove, with ships cleared for action. Von Spee's flagship, the "Scharnhorst," was the gold medal ship for gunnery in the German navy, and it was her 8.2-inch salvos that had contributed mainly to the sinking of the "Good Hope" and "Monmouth."

The fight was no sooner well under way, we are told, than out of Port Stanley steamed the two battle-cruisers. They took on the "Scharnhorst" and "Gneisenau" and left the smaller ships to fight it out among themselves. Von Spee signaled his fleet to scatter, and himself ranged up for the last, bravely-fought battle of his life.

It would be very interesting to know at what range the fight between these four ships was fought. Theoretically, Admiral Sturdee, having the more powerful gun and the higher speed, should have fought just outside the range at which the 8.2-inch shells of the Germans could land with serious effect. Judging from the fact that the action lasted from 1 P. M. to 6 P. M. and that the total casualties in the whole British fleet were only nine killed and a few wounded, it is probable that Sturdee, having the speed gage, fought at an extreme range, probably 12,000 to 14,000 yards, being content to sink the German ships gradually with a minimum loss of his own personnel.

BRITISH SQUADRON.

Name.	Type.	Date.	Displace'mt.	Belt armor.	Guns.	Speed.
"Invincible"	Battle Cruiser	1908	17,250 tons	7-inch	8-12",16-4"	26.5
"Inflexible"	Battle Cruiser	1908	17,250 tons	7-inch	8-12", 16-4"	26.5
"Carnarvon"	Armored Cruiser	1904	10,850 tons	6-inch	4-7.5", 6-6"	23.0
"Cornwall"	Armored Cruiser	1901	9,800 tons	4-inch	14-6"	23.5
"Kent"	Armored Cruiser	1903	9,800 tons	4-inch	14-6"	23.0
"Bristol"	Scout Cruiser	1911	4,800 tons	none	2-6", 10-4"	26.5
"Glasgow"	Scout Cruiser	1911	4,800 tons	none	2-6", 10-4"	26.5
"Canopus"	Coast Defense Ship	1897	12,950 tons	6-inch	4-35cal. 12", 12-6"	16.5
GERMAN SQUADRON.						
"Scharnhorst"	Armored Cruiser	1907	11,600 tons	6-inch	8-8.2", 6-6"	23.5
"Gneisenau"	Armored Cruiser	1907	11,600 tons	6-inch	8-8.2", 6-6"	23.5
"Leipzig"	Protected Cruiser	1906	3,250 tons	none	10-4"	23.0
"Nurnberg"	Scout Cruiser"	1908	3,450 tons	none	10-4"	24.0
"Dresden"	Scout Cruiser	1908	3,600 tons	none	10-4"	24.0

The Germans fought it out with characteristic courage to the very end, the "Scharnhorst" going down by the stern, with the admiral's flag flying from the main yard. The "Gneisenau" went under a little later; and after a spirited action the "Glasgow," which was in the Chilean fight, sunk the "Leipzig." Subsequently the "Nurnberg" was overtaken and sent to the bottom. The "Dresden" escaped and is still at large.

A New Cement Product

It is likely that South Germany will furnish a supply of trass for cement making that promises to be of value. It has recently been found that the volcanic tufa which makes up the subsoil between Bischingen and Tapfheim is quite superior to the trass of the Rhine region. The new trass of the Danube, however, presents, in the usual method of cement mixing (1 part each of trass, lime and sand with water), an excellent resistance to strains, and the qualities of the trass mortar will allow it to replace cement mortar, the cost of which is 50 per cent higher. Such mortar is slower in hardening than cement mortar, but on the other hand is said to be more elastic, stronger, and less porous. Besides, it is rare that such mortar, when well prepared, will show cracks as in the usual cases. It can be worked as well in very cold weather as at other temperatures, so that it can be used throughout the winter. When in the powdered state, trass does not suffer from dampness, and is not deteriorated by lying in storehouse for long periods. Another point is that 100 parts of it give as much mortar as 150 parts of cement. The operating of the trass quarries in south Germany promises to be a good venture, for there is no doubt among competent authorities that ordinary cements can be replaced by this material.

Federal Aid for Good Roads.—The American Road Congress, recently held at Atlanta, endorsed the principle of Federal co-operation toward the construction of main highways in the several States, and the Government was urged to construct roads across all Indian reservations, forest reservations and other federalized areas where such connecting links are essential parts of through routes of travel. Uniform road legislation was urged on all States, as well as the passage of road laws in those States as have not yet done so.

Which Pleasure Car Fits the Buyer's Purse?

A Price List and Reference Table of 1915 American Gasoline Pleasure Cars

Compiled by C. Edward Palmer

DURING the past year or two the trend in automobile design has been toward the refinement of details, the strengthening of weak points, and simplification of operation. Except in a few specific instances, no marked changes in design have been made, although many manufacturers have amplified body construction and added features here and there, which have made for luxury, both for passengers and driver. Whereas, three or four seasons ago, the electric starting and lighting system attracted much attention at the automobile shows, this year it is supplied as regular equipment on more than 90 per cent of the cars manufactured in this country.

For the average prospective purchaser, the problem of buying a car has narrowed down to the question, "Which car fits my purse?" Within the range of price he can pay, the customer will find a large number of cars to select from. It is with the object of assisting such visitors at the automobile shows or salesrooms that the following tables have been compiled.

Except for the abbreviations used, the table is self-explanatory. In each price column the first figure indicates the number of cylinders, while the second gives the rated horse-power. The small letters refer to the type of body which may be obtained with that particular chassis at the price indicated, while the capital letters tell whether the car is equipped with self-starter and electric lights. Thus, r means roadster body; t, touring car; c, coupé; s, sedan; p, phaeton; b, berline; l, limousine, and ld, landaulet. S indicates self-starter, and E, electric lights.

While the table does not include every car manufactured in the country, nor does it include all companies making only a few cars per year, it does give the more important and representative models of the companies listed. Where further information is desired, manufacturers will supply catalogues, detailed specifications, etc., on request.

Name of Car	Name and Address of Manufacturer	Under $700	$700 to $1,200	$1,201 to $2,000	$2,001 to $3,000	$3,001 to $4,000	Over $4,000
Abbott-Detroit	Abbott Motor Car Co., Detroit, Mich			4, 40, r,t,S,E, $1,875	6, 60, r,t,S,E, $2,290	6, 60, l,S,E, $3,500	
Allen	Allen Motor Co., Fostoria, O		4, 35, r,t,S,E, $895	4, 40, r,t,S,E, $1,395			
Alter	Alter Motor Car Co., Plymouth, Mich	4, 27, r,t,S,E, $685					
Ames	Ames Motor Car Co., Owensboro, Ky			4, 27, r,t,S,E, $1,785			
A. E. C	Auger Eng. Co., Milwaukee, Wis				6, 50, r,t,S,E, $2,500 6, 60, r,t,S,E, $2,750		
Apperson	Apperson Bros. Auto Co., Kokomo, Ind			4, t,S,E, $1,350 6, t,S,E, $1,485	6, r,t,S,E, $2,200		
ArBenz	ArBenz Car Co., Chillicothe, Ohio			4, 48, r,S,E, $1,825 4, 48, t,S,E, $1,885			
Auburn	Auburn Automobile Co., Auburn, Ind		4, 36, r,t,S,E, $1,075	6, 47, t,S,E, $2,000			
Austin	Austin Automobile Co., Grand Rapids, Mich					6, 49, r,t,S,E, $3,600	6, 49, l,S,E, $4,700
Benham	Benham Manufacturing Co., Detroit, Mich				6, 48, r,t,S,E, $2,485		
Briscoe	Briscoe Motor Co., Inc., Jackson, Mich		4, 30, r,t,S,E, $785	4, 30, c,S,E, $1,250			
Buick	Buick Motor Co., Flint, Mich		4, 28, r,t,S,E, $900	4, 37, t,S,E, $1,250 6, 55, t,S,E, $1,650			
Cadillac	Cadillac Motor Car Co., Detroit, Mich			8, 31 to 60 r,t,S,E, $1,975	8, 31 to 60, ld,S,E, $2,500	8, 31 to 60, l,S,E, $3,450	
Cartercar	Cartercar Co., Pontiac, Mich			4, 30, r,t,S,E, $1,250			
Case	J. I. Case T. M. Co., Inc., Racine, Wis			4, 40, t,S,E, $1,800 4, 25, r,t,S,E, $1,350			
Chadwick	Chadwick Engine Works, Pottstown, Pa						6, 60, r,t,S,E, $5,500 6, 60, l,S,E, $6,500
Chalmers	Chalmers Motor Co., Detroit, Mich			6, 48, r,t,S,E, $1,650	6, 60, t,S,E, $2,400	6, 48, c,s,S,E, $3,200	
Chandler	Chandler Motor Car Co., Cleveland, O			6, 35, r,t,S,E, $1,595	6, 35, l,s,S,E, $2,750		
Chevrolet	Chevrolet Motor Co., Flint, Mich		4, 24, r, $750 4, 24, t, $875	6, 30, t,S,E, $1,425			
Cole	Cole Motor Car Co., Indianapolis, Ind			4, 29, r, t,c,S,E, $1,485 6, 29, r, t,c,S,E, $1,865	6, 44, r,t,c,l,S,E, $2,465		
Coey	Coey Motor Co., Chicago, Ill	4, 18, r, $425					
Crane	Crane Motor Car Co., Bayonne, N. J						6, 46, chassis, $7,500
Crow-Elkhart	Crow Motor Car Co., Elkhart, Ind		4, 16, t,S,E, $725 4, 26, t,S,E, $1,175	4, 29, t,S,E, $1,495			
Crawford	Crawford Automobile Co., Hagerstown, Md			6, 35, t,S,E, $1,850			
Crescent	Crescent Motor Co., Cincinnati, Ohio			4, 29, t,S,E, $1,275 6, 38, t,S,E, $1,985			
Cunningham	Jas. Cunningham, Son & Co., Rochester, N. Y					4, 40, r,t,S,E, $3,500	4, 40, l,ld,S,E, $5,000
Davis	George W. Davis Motor Car Co., Richmond, Ind			4, 38, r,t,S,E, $1,235	6, 50, t,S,E, $2,150		
De Tamble	De Tamble Motors Co., Anderson, Ind		4, 24, r,S,E, $795 4, 24, t,S,E, $845				
De Soto	De Soto Motor Car Co., Auburn, Ind	2, 10, r, $325					
Detroiter	Briggs-Detroiter Co., Detroit, Mich		4, 32, r,t,S,E, $985				
Dispatch	Dispatch Motor Car Co., Minneapolis, Minn		4, 30, r, $850	4, 30, t,S,E, $1,210			
Dodge	Dodge Bros., Detroit, Mich		4, 35, t,S,E, $785				
Dodge	Dodge Motor Car Co., Detroit, Mich	4, 30, r,S,E, $595					
Dorris	Dorris Motor Car Co., St. Louis, Mo				4, 48, t,S,E, $2,200	4, 48, l,S,E, $3,400	
Empire	Empire Automobile Co., Indianapolis, Ind		4, 32, r,t,S,E, $975				
Enger	Enger Motor Car Co., Cincinnati, Ohio			6, 50, r,t,l,S,E, $1,495			
Franklin	H. H. Franklin Manf. Co., Syracuse, N. Y				6, 30, r,t,S,E, $2,150 6, 30, s,S,E, $3,000		
Ford	Ford Motor Co., Detroit, Mich	4, 20, r,E, $440 4, 20, t,E, $490	4, 20, c,E, $750 4, 20, s,E, $975				
Fiat	F. I. A. T., Poughkeepsie, N. Y						4, 55, r,t,S,E, $4,650 6, 50, r,t,S,E, $5,150
Firestone-Columbus	New Columbus Buggy Co., Columbus, Ohio			4, 35, r,t,c,S,E, $1,850	6, 60, r,t,l,S,E, $2,600		
Fischer	C. J. Fischer Co., Detroit, Mich	4, —, r,t,S,E, $595	4, —, s,S,E, $845				
Gary	Gary Automobile Mfg. Co., Gary, Ind				6, 34, t,S,E, $2,350		
Glide	Bartholomew Co., Peoria, Ill		4, 30, t,S,E, $1,195				
Grant	Grant Motor Co., Findlay, Ohio	4, 21, r,t,l,S,E, $505	6, 36, r,t,l,S,E, $795				
Great Western	Great Western Auto Co., Peru, Ind			4, 40, r,t,S,E, $1,710			
Haynes	Haynes Automobile Co., Kokomo, Ind			6, 55, r,t,S,E, $1,485 6, 55, c,S,E, $1,750			
Herff-Brooks	Herff-Brooks Corporation, Indianapolis, Ind		4, 40, t,S,E, $1,100	6, 50, r,t,S,E, $1,375			
Herreshoff	Herreshoff Light Car Co., Troy, N. Y	4, 10, r,S,E, $500					
Holly	Holly Motor Co., Mt. Holly, N. J				6, 45, t,S,E, $2,750		
Hudson	Hudson Motor Car Co., Detroit, Mich			6, 40, r,p,S,E, $1,550	6, 40, l,S,E, $2,550		
Hupmobile	Hupp Motor Car Co., Detroit, Mich		4, 36, r,t,S,E, $1,200	4, 36, c,s,S,E, $1,325			
Imperial	Imperial Automobile Co., Jackson, Mich		4, 36, t,S,E, $1,085		6, 50, t,S,E, $2,200		
Inter-State	Inter-State Motor Co., Muncie, Ind		4, 30, t,S,E, $1,000				
Jackson	Jackson Automobile Co., Jackson, Mich			4, 45, r,t,S,E, $1,375 6, 45, t,S,E, $1,650			
Jeffery	Thomas B. Jeffery Co., Kenosha, Wis			4, 38, r,t,s,l,S,E, $1,450 6, 42, r,t,s,l,S,E, $1,650			
King	King Motor Car Co., Detroit, Mich		4, 26, r,t,S,E, $1,165				
Kissel	Kissel Motor Car Co., Hartford, Wis			4, 36, r,t,S,E, $1,450	6, 48, r,t,S,E, $2,350	6, 60, r,t,S,E, $3,150	6, 60, l,S,E, $4,900
Kline-Kar	Kline Motor Car Corporation, Richmond, Va			6, 42, r,t,S,E, $1,850	6, 42, l,S,E, $2,800		
Knox	Knox Motors Co., Springfield, Mass					4, 45, r,t,l,S,E, $3,850	6, 46, r,t,l,S,E, $4,500 6, 66, r,t,l,S,E, $5,000
Krit	Krit Motor Car Co., Detroit, Mich		4, 30, r,t,S,E, $850	4, 30, c,S,E, $1,295			
Lambert	Buckeye Manufacturing Co., Anderson, Ind		4, 25, r, $950 4, 30, t,S,E, $1,200	6, 45, t,S,E, $1,375 4, 40, t,S,E, $1,450			
Lewis Six	L-P-C Motor Co., Racine, Wis			6, 38, t,S,E, $1,600			
Lexington	Lexington Howard Co., Connersville, Ind			4, 40, r,t,S,E, $1,375	6, 60, t,S,E, $2,575		
Locomobile	Locomobile Co. of America, Bridgeport, Ct						6, 38, r,t,S,E, $4,400 6, 38, l,S,E, $5,400 6, 48, r,t,l,S,E, $5,100
Lozier	Lozier Motor Car Co., Detroit, Mich				4, 29, r,t,S,E, $2,100	6, 36, t,S,E, $3,250	6, 36, l,S,E, $4,625
Luverne	Luverne Automobile Co., Luverne, Minn				6, 60, r,t,S,E, $2,500		
Lyons-Knight	Lyons-Atlas Co., Indianapolis, Ind				4, 32, r,t,S,E, $2,900	4, 32, s,S,E, $3,900	4, 32, l,S,E, $4,300
Marion	Marion Motor Co., Indianapolis, Ind			4, 36, r,t,S,E, $1,650	6, 50, r,t,S,E, $2,150		
Marmon	Nordyke & Marmon Co., Indianapolis, Ind					6, 41, r,t,S,E, $3,250	6, 48, r,t,S,E, $5,000 6, 48, l,S,E, $6,500
Mason	Mason Motor Co., Waterloo, Iowa		4, 55, t,S,E, $1,150				
Maxwell	Maxwell Motor Car Co., Detroit, Mich	4, 25, t, $695 4, 25, c, $840					
McFarlan	McFarlan Motor Co., Connersville, Ind				6, 38, r,t,S,E, $2,590	6, 38, c,S,E, $3,300 6, 38, l,S,E, $4,000	
McIntyre	W. H. McIntyre Co., Auburn, Ind	4, 23, t,S,E, $695		6, 28, t,S,E, $1,275			
Metz	Metz Co., Waltham, Mass	4, 22, r, $495					
Mitchell	Mitchell-Lewis Motor Co., Racine, Wis			4, 35, r,t,l,S,E, $1,250 6, 50, r,t,S,E, $1,895	6, 60, t,S,E, $2,350		
Moline-Knight	Moline Automobile Co., East Moline, Ill				4, 50, r,t,S,E, $2,500	4, 50, l,S,E, $3,800	
Monarch	Monarch Motor Car Co., Detroit, Mich			6, 45, t,S,E, $1,250			
Moon	Moon Motor Car Co., St. Louis, Mo			4, 38, t,S,E, $1,350	6, 50, t,S,E, $2,250		
Moyer	H. A. Moyer, Syracuse, N. Y				4, 32, r,t,S,E, $2,400	6, 48, t,S,E, $3,250	
National	National Motor Vehicle Co., Indianapolis, Ind				6, 55, r,t,S,E, $2,375 6, 55, c,S,E, $2,850		
Norwalk	Norwalk Motor Car Co., Martinsburg, W. Va			6, 30, r,t,S,E, $1,875	6, 60, r,t,S,E, $2,850		
Oakland	Oakland Motor Car Co., Pontiac, Mich		4, 39, r,S,E, $1,100	6, 54, t,S,E, $1,685			
Oldsmobile	Olds Motor Works, Lansing, Mich			4, 30, r,t,S,E, $1,285	6, 50, t,S,E, $2,975		
Overland	Willys-Overland Co., Toledo, Ohio		4, 30, t,S,E, $850 4, 35, r,t,S,E, $1,050	6, 50, t,S,E, $1,475			
Packard	Packard Motor Car Co., Detroit, Mich					6, 38, r,p,S,E, $3,750 6, 38, t,S,E, $3,850	6, 48, t,S,E, $4,850 6, 48, l,S,E, $6,100
Paige	Paige-Detroit Motor Car Co., Detroit, Mich		4, 36, r,t,S,E, $1,195	6, 46, r,t,S,E, $1,395			
Partin-Palmer	Partin Manufacturing Co., Chicago, Ill		4, 38, t,S,E, $1,075 4, 20, r,S				
Paterson	W. A. Paterson Co., Flint, Mich		4, 32, t,S,E, $1,095	6, 48, t,S,E, $1,495			
Pathfinder	Motor Car Manufacturing Co				6, 50, r,t,S,E, $2,222 6, 50, t,l,S,E, $2,997		

Which Pleasure Car Fits the Buyer's Purse?—Concluded

Name of Car	Name and Address of Manufacturer	Under $700	$700 to $1,200	$1,201 to $2,000	$2,001 to $3,000	$3,001 to $4,000	Over $4,000
Peerless	Peerless Motor Car Co., Cleveland, Ohio			4, 22, r,t,l,S,E, $2,000			6, 48, r,t,l,c,S,E, $5,000
Pierce-Arrow	Pierce-Arrow Motor Car Co., Buffalo, N.Y.						6, 38, t,S,E, $4,300 6, 48, t,S,E, $5,000 6, 66, t,S,E, $6,000
Pilot	Pilot Motor Car Co., Richmond, Ind.			6, 55, t,S,E, $1,885	6, 75, r,t,S,E, $2,885		
Pratt	Elkhart Carriage and Harness Co., Elkhart, Ind.			4, 40, r,t,S,E, $1,850 4, 40, t,S,E, $2,000	6, 50, r,t,S,E, $2,150		
Premier	Premier Motor Manf. Co., Indianapolis, Ind.				6, 32, r,t,S,E, $2,385		
Pullman	Pullman Motor Car Co., York, Pa.		4, 30, r,t,S,E, $740		6, 48, r,t,S,E, $2,500		
Rayfield	Rayfield Motor Co., Chrisman, Ill.	4, 18, r,E, $395 4, 18, r,S,E, $475					
R-C-H	R-C-H Corporation, Detroit, Mich.		4, 25, t,S,E, $900				
Regal	Regal Motor Car Co., Detroit, Mich.		4, 39, r,t,S,E, $1,085				
Reo	Reo Motor Car Co., Lansing, Mich.		4, 35, t,S,E, $1,175				
Republic	Republic Motor Car Co., Hamilton, Ohio				6, 60, t,S,E, $2,950		
Richard	Richard Auto Manf. Co., Cleveland, Ohio				4, 25, r,t,l,S,E, $2,250		
Richmond	Wayne Works, Richmond, Ind.		4, 40, r,t,S,E, $1,125	6, 50, r,t,S,E, $1,375			
S. G. V.	S. G. V. Co., Reading, Pa.				4, 35, r,t,S,E, $2,800		4, 40, l,S,E, $4,250
Saxon	Saxon Motor Co., Detroit, Mich.	4, 15, r,S,E $465					
Simplex	Simplex Automobile Co., New Brunswick, N.J.						4, 46, l,S,E, $4,500
Singer	Singer Motor Co., Inc., Long Island City, N.Y.				6, 60, r,t,S,E, $2,350		
Speedwell	Speedwell Motor Car Co., Dayton, Ohio				6, 41, r,t,S,E, $2,850		
Spenny	Spenny Motor Car Co., Chicago, Ill.		4, 30, r,t,S,E, $1,075			6, 60, t,S,E, $3,750	
Sphinx	Sphinx Motor Car Co., York, Pa.	4, 28, t,S,E $695					
Spoerer	Carl Spoerer Sons Co., Baltimore, Md.			4, 25, r,t,S,E, $2,000	4, 40, r,t,S,E, $3,000		
Stearns	F. B. Stearns Co., Cleveland, Ohio			4, 22, r,t,S,E, $1,750		4, 29, r,t,S,E, $3,750	6, 46, r,t,S,E, $4,850
Stevens-Duryea	Stevens-Duryea Co., Chicopee Falls, Mass.						6, 46, r,t,S,E, $4,550 6, 46, l,S,E, $5,800 6, 48, l,b,p,S,E, $6,200
Studebaker	Studebaker Corp., Detroit, Mich.		4, 20, r,t,S,E, $985	6, 29, t,S,E, $1,385			
Stutz	Stutz Motor Car Co., Indianapolis, Ind.			4, 40, r,S,E, $1,475 6, 50, r,t,S,E, $2,000		6, 60, t,l,S,E, $3,675	
Thomas	E. R. Thomas Motor Car Co., Buffalo, N.Y.					6, 43, r,t,l,S,E, $3,250	
Touraine	Touraine Co., Philadelphia, Pa.					6, 60, t,S,E, $3,250	6, 60, l,S,E, $4,550
Traveler	Traveler Motor Car Co., Detroit, Mich.		4, 17, t,S,E, $795				
Velie	Velie Motor Vehicle Co., Moline, Ill.			6, 40, r,t,S,E, $1,595	6, 50 r,t,S,E, $2,015		
Vulcan	Vulcan Manf. Co., Painesville, Ohio		4, 33, t,S,E, $912				
Westcott	Westcott Motor Car Co., Richmond, Ind.		4, 35, r,t,S,E, $1,185	6, 50, r,t,S,E, $1,585			
White	White Co., Cleveland, Ohio				4, 30, r,t,s,S,E, $2,700	4, 45, t,l,ld,S,E, $3,800	6, 60, t,S,E, $5,500
Willys-Knight	Garford Co., Elyria, Ohio				4, 38, r,t,S,E, $2,750		
Winton	Winton Motor Car Co., Cleveland, Ohio					6, 48, r,t,S,E, $3,250	
Zimmerman	Zimmerman Manufacturing Co., Auburn, Ind.	2, 16, r, $395		6, 50, t,S,E, $1,750			

Which Electric Pleasure Car Fits the Buyer's Purse?

A Self-explanatory Table of the 1915 Models of American Pleasure Cars

Name of Car	Name and Address of Manufacturer	Under $2,500	$2,500 to $3,000	Over $3,000.
Argo	American Electric Car Company, Saginaw, Mich.	4p Roadster, $2,350	5p Brougham, $2,800	
Baker	Baker Motor Vehicle Co., Cleveland, Ohio	2p Roadster, $2 300	3p Coupe, $2,800	4p Brougham, $3,250
Borland	American Electric Car Company, Saginaw, Mich.	2p Roadster, $2,250	5p Brougham, $2,550	7p Limousine, $5,500
Bailey	S. R. Bailey & Co., Inc., Boston, Mass.	2p Roadster, $2,325	4p Roadster, $2,580	
Beardsley	Beardsley Electric Company, Los Angeles, Cal.		3p Roadster, $2,500 5p Brougham, $3,000	
Broc	American Electric Car Company, Saginaw, Mich.			5p Brougham, $3,100 5p Brougham, $3,200
Buffalo	Buffalo Electric Vehicle Company, Buffalo, N. Y.			5p Coupe, $3,250
Century	Century Electric Car Co., Detroit, Mich.		4p Brougham, $2,650	5p Brougham, $3,250
Chicago	Chicago Electric Motor Car Company, Chicago, Ill.		4p Lim., $2,600, 5p Lim., $2,800	
Columbus	New Columbus Buggy Company, Columbus, Ohio	4p Colonial Coupe, $2,350	4p Brougham, $2,800 5p Brougham, $3,000	
Detroit	Anderson Electric Car Company, Detroit, Mich.		3p Cabriolet, $2,650 5p Brougham, $3,000	
Flanders	Flanders Electric, Inc., Detroit, Mich.	4p Coupe, $1,750		
Fritchle	Fritchle Auto and Battery Company, Denver, Colo.	2p Torpedo Roadster, $2,400	4p Torpedo Roadster, $2,500	5p Brougham, $3,600
Grinnell	Grinnell Electric Car Co., Detroit, Mich.		4p Brougham, $3,000	5p Brougham, $3,400
Ohio	Ohio Electric Car Company, Toledo, Ohio		3p Roadster, $2,650 4p Coupe, $2,700	5p Coupe, $3,200 5p Coupe, $3,500
Rauch & Lang	Rauch & Lang Carriage Co., Cleveland, O.		2p, Roadster, $2,600 4-5p, Brougham, $2,950	5p, Coach. $3,200
Ward	Ward Motor Vehicle Company, Mt. Vernon, N. Y.	4p Coupe, $2,100		
Waverley	Waverley Company, Indianapolis, Ind.	3p Roadster-Coupe, $2,000 4p Brougham, $2,300	4p Brougham, $2,750 5p Limousine, $3,000	
Woods	Woods Motor Vehicle Company, Chicago, Ill.		4p Brougham, $2,850	5p Brougham, $3,100

Business Man's Reference Table of Commercial Vehicles

The Latest Models of American Gasoline Motor Trucks and Delivery Cars, Arranged According to Tonnage Carrying Capacity

Compiled by C. Edward Palmer

FOR a business which warrants the purchase of commercial vehicles to haul its goods great care is usually exercised, both by the buyer and the seller, to select a vehicle of the proper horse-power and body capacity for the particular class of goods to be handled. For this reason the business man is usually interested more in the size and capacity of a truck than in its price.

In the following table the vehicles are listed alphabetically according to name, and are grouped according to tonnage capacity. In the tonnage columns, the first figure indicates the tons capacity, and the second the horse-power of the truck at the price given. As most manufacturers build bodies to order, to suit the business of the purchaser, the prices given are mostly for chassis only.

Motor truck manufacturers have made a careful study of the transportation requirements of many businesses and are glad to co-operate with purchasers in the efficient installation of commercial vehicle service.

Name of Vehicle	Name and Address of Manufacturer	Tons Capacity, Horse-power and Price						
		Under 1 ton	1 - 1½	2 - 2½	3 - 3½	4	5	6 and over
Adams	Adams Bros. Co., Findlay, Ohio		1, 30, $1,850	2, 35, $2,500				
Aetna	Aetna Motor Truck Co., Detroit, Mich.		1½, $2,150	2½, $2,400				
American Daimler	General Vehicle Co., Inc., Long Island City, N. Y.							6, 35
Armleder	O. Armleder Co., Cincinnati, Ohio		1, 30, $2,200	2, 40, $2,150				
Atterbury	Atterbury Motor Car Co., Buffalo, N. Y.	¾, 25, $1,800	1, 30, $2,100	2, 40, $2,800	3, 50, $3,400		5, 50, $4,000	
Available	Available Truck Co., Chicago, Ill.		1, 30	2, 40				
Avery	Avery Co., Peoria, Ill.		1, 27, $1,690	2, 36, $2,700	3, 36, $3,200		5, 45, $4,500	
Auglaize	Auglaize Motor Car Co., New Bremen, Ohio	¾, 28, $950	1, 32, $1,200					
Autocar	Autocar Co., Ardmore, Pa.		1½, 18, $1,850					
Barker Motor Wagon	C. L. Barker, Norwalk, Conn.		1, $2,000	2, $2,400				
Bessemer	Bessemer Motor Truck Co., Grove City, Pa.		1½, 27, $1,800	2, 27, $2,300				
Best	Durant-Dort Carriage Co., Flint, Mich.	½, 16, $750						
Blair	Blair Motor Truck Co., Newark, Ohio			2, 35, $2,850	3, 40, $3,250	4, 40, $3,750	5, 40, $4,500	
Brockway	Brockway Motor Truck Co., Cortland, N. Y.	¾, 20, $1,250	1¼, 25, $1,650	2, 35, $1,950				
Buick	Buick Motor Co., Flint, Mich.	¾, 38, $1,150						
Bulley Tractor and Mercury Trucks	Mercury Manufacturing Co., Chicago, Ill.	½, 14, $750	1½, 30, $3,400					
Cass and Independent	Independent Motors Co., Port Huron, Mich.	¾, 23, $1,285	1½, 27, $1,850					
Champion	Famous Manufacturing Co., East Chicago, Ind.		1, 24, $750	2, 35, $1,250	3, 45, $1,750			
Chase	Chase Motor Truck Co., Syracuse, N. Y.	½, 15, $750	1½, 30, $2,200		3, 40, $3,300			
Clark	Clark Delivery Car Co., Chicago, Ill.		1½, 30, $1,800					
Coleman	F. Coleman Carriage and Harness Co., Ilion, N. Y.		1, 23, $2,100	2, 23, $2,550	3, 27, $3,150			
Commer	Commercial Cars, Ltd., New York City				3, 30, $3,500	4, 35, $4,000	5, 40, $4,500	7, 45, $5,000
Commerce	Commerce Motor Car Co., Detroit, Mich.	¾, $975						
Corbitt	Corbitt Automobile Co., Henderson, N. C.		1¼, 35, $2,000	2, 40, $2,300				
Couple Gear	Couple Gear Freight Wheel Co., Grand Rapids, Mich.					4, 45, $5,000		6, 55, $5,600 12, 70, $6,500


DETROIT
SPRINGS
Roll of Honor
The Names shown below represent some of the users of Detroit Springs
Pleasure Cars
Cole Lyons-Knight
Dodge Bros.
Marmon Hupmobile
National Kissel Kar
Oakland Pathfinder
Detroit Electric
Trucks
Denby Republic
Federal Signal
G. M. C. Standard
Krebs J. C. Wilson
Individually Designed
DETROIT Springs are built to such a high standard that we are able to guarantee them for two years. In the first place, they are designed and built for the particular model of car upon which they are to be used.
They are built for more than safety, that is—Emergency Shocks.
They are built for lasting Comfort—for Car Protection—minimum wear on mechanism and tires.
In addition to the Two-Year Guarantee and all the quality that implies, is the Self-Lubricating feature.
Near the end of each leaf is a small saucer-like depression filled with a long-lived lubricant, which spreads between the leaves as they move over each other.
By this simple device, Detroit Springs always operate smoothly and silently.
Write for free book, "From the Ore to the Motor Car," telling how springs are made.
RESILIENT
Detroit Springs
SILENT TRADE MARK SELF-LUBRICATING
Detroit Steel Products Co.
2230 East Grand Boulevard, Detroit, Michigan

A Business Man's Reference Table of Commercial Vehicles.—Concluded

Name of Vehicle	Name and Address of Manufacturer	Tons Capacity, Horse-power and Price						
		Under 1 ton	1 - 1½	2 - 2½	3 - 3½	4	5	6 and over
Croce	Croce Automobile Co., Asbury Park, N. J	¾, 22, $1,800	1, 28, $1,850	2, 30, $2,600	3, 36, $3,600			
Crown	Crown Commercial Car Co., North Milwaukee, Wis		1, 28, $2,000	2, 35, $2,500	3, 40, $3,000			
Duplex Four-wheel Drive	Duplex Power Car Co., Charlotte, Mich			2, 32, $2,800	3, 40, $3,200			
Dorris	Dorris Motor Car Co., St. Louis, Mo	¾, 48, $1,950		2, 48, $2,500				
Doyle	J. C. Doyle, Seattle, Wash		1½,30.$1,750		3, 50, $2,750			10, 90, $4.750
Diamond T	Diamond T Motor Car Co., Chicago, Ill	¾,25,$2,000	1½,30,2,250	2, 30, $2,500	3, 40, $3,600			
Dispatch	Dispatch Motor Car Co., Minneapolis, Minn	½, 30, $900						
Denby	Denby Motor Truck Co., Detroit, Mich	¾, 20,	1, 20,					
Delahunty	Delahunty Dyeing Machine Co., Pittston, Pa		1½,30,$1,800					
Dart	Dart Motor Truck Co., Waterloo, Ia	½, 20, $875	1, 24, $1,400	2, 35, $1,800				
Durable Dayton	Durable Dayton Truck Co., Dayton, Ohio			2, 36, $1,800	3, 45, $2,250	4, 45, $2,700	5, 60, $3,100	6, 60, $3,500
Fargo	Fargo Motor Car Co., Chicago, Ill		1, 23, $1,250					
Four-Wheel Drive	Four-Wheel Drive Auto Co., Clintonville, Wis			2, 29, $3,600	3, 36, $4,000			6, 44, $4,800
Federal	Federal Motor Truck Co., Detroit, Mich		1½,30,$1,800					
Flint	Durant-Dort Carriage Co., Flint, Mich		1, 23, $1,190					
Fremont-Mais	Lauth-Juergens Motor Car Co., Fremont, Ohio		1½,30,$1,700					
G. M. C	General Motors Truck Co., Pontiac, Mich	¾, 20, $1,090	1¼,20,$1,500	2, 26, $1,900	3½,40,$2,500		5, 40, $3,000	
Gabriel	Gabriel Auto Co., Cleveland, Ohio	½,22,$1,000 ¾,28,$1,600	1,30,$2,000 1½,35,$2,400					
Garford	Garford Co., Elyria, Ohio			2, 29, $3,000	3, 29, $3,500	4, 29, $3,850	5, 29, $4,500	6, 29, $4,850
Gay	S. G. Gay Co., Ottawa, Ill	¾, 25, $1,500	1½,30,$1,700					
B. A. Gramm	Gramm-Bernstein Co., Lima, Ohio	¾, $1,500	1½, $1,800	2, $2,600	3½, $3,500			6, $4,300
Hahn	Hahn Motor Truck and Wagon Co., Hamburg, Pa		1, 30,	2, 40,	3, 45,			
Handy Wagon	Auburn Motor Chasis Co., Auburn, Ind	¼, 11, $295 ⅜, 18, $575						
Harvey	Harvey Motor Truck Works, Harvey, Ill		1½,30,$1,800		3, 40, $3,000			
Hendrickson	Hendrickson Motor Truck Co., Chicago, Ill		1½,30,$1,550	2, 30, $1,850	3, 35, $2,400	4. 45, $3,400		
Horner	Detroit-Wyandotte Motor Co., Wyandotte, Mich		1, 33, $2,000	2, 33, $2,650	3, 36, $3,200		5, 46, $4,200	
Hupmobile	Hupp Motor Car Co., Detroit, Mich	⅖, 32, $1,050						
Hurlburt	Hurlburt Motor Truck Co., New York City		1, 22, $1,500	2, 28, $3,000	3½,32,$3,500			
Ideal	Ideal Auto Co., Fort Wayne, Ind		1½,35,$2,000					
Interboro	Interboro Motor Truck Co., Philadelhpia, Pa		1, 23, $1,850					
International	International Harvester Corp., Chicago, Ill	½, 20,						
Jeffery	Thomas B. Jeffery Co., Kenosha, Wis	¾, 38, $1,300	1, 35, $1,500	2, 38, $2,750				
Kalamazoo	Kalamazoo Motor Vehicle Co., Kalamazoo, Mich		1½,30,$1,590					
Kelley-Springfield	Kelley-Springfield Motor Truck Co., Springfield, Ohio		1, 30, $2,000	2, 30, $2,750	3½,40,$3,400	4, 40, $3,685	5, 40, $4,250	6, 40, $4,550
King	A. R. King Manufacturing Co., Kingston, N. Y				3½,32,$3,350			
Kissel Kar	Kissel Motor Car Co., Hartford, Wis	¾, 36, $1,500	1, 36, $1,850	2½,40,$2,750	3½,40,$3,350			6, 50, $4,350
Knickerbocker	Knickerbocker Motor Truck Manufacturing Co., New York City				3½,40,$3,750	4, 40, $4,000	5, 40, $4,500	
Knox Tractor	Knox Motor Co., Springfield, Mass						5, 40, $3,250	10, 40,$3,750
Koehler	H. J. Koehler Sporting Goods Co., Newark, N. J		1, 24, $750					
Kopp	Kopp Motor Truck Co., Buffalo, N. Y			2, 30,	3½, 38,			6, 49,
Kosmath	Kosmath Co., Detroit, Mich	½, 18, $700 ¾, 22, $960						
Krebs	Krebs Commercial Car Co., Clyde, Ohio	¾, 23, $1,450	1, 23, $1,900	2, 28, $2,350				
LaFrance-Hydraulic	American LaFrance Fire Engine Co., Inc., Elmira, N. Y							6¼,48,$5.500
Lambert	Buckeye Manufacturing Co., Anderson, Ind	⅝, 25, $950	1½,35,$1,900	2, 40, $2,300				
Lange	Lange Motor Truck Co., Pittsburg, Pa		1½,23,$2,250	2½,27,$3,000				
Lewis	Lewis Motor Truck Co., Inc., Oakland. Cal			2½,35,$2,900	3, 35, $3,250		5, 50, $4,400	6, 50, $4,500
Lippard-Stewart	Lippard-Stewart Motor Car Co., Buffalo, N. Y	¾, 30, $1,650	1, 30, $2,000	2, 35, $2,600				
Little Giant	Chicago Pneumatic Tool Co., Chicago, Ill		1, 25, $1,350					
Locomobile	Locomobile Company of America, Bridgeport, Conn				3, 30, $3,500	4, 30, $3,650	5, 40, $4,500	6, 40, $4,800
Longest	Longest Brothers Co., Louisville, Ky					4, 40, $4,000		6, 40, $4,500
Mais	Mais Motor Truck Co., Indianapolis, Ind		1½,40,$2,750	2, 40, $2,950	3, 45, $3,400			
Martin	Martin Carriage Works, Inc., York, Pa		1½,30,$2,150	2½,35,$2,850	3½,50,$3,500			
Mansur	Mansur Motor Truck Co., Haverhill, Mass		1½,30,$2,300		3, 35, $3,000			
McIntyre	W. H. McIntyre Co., Auburn, Ind		1½,28,$2,300	2, 28, $2 800	3, 28, $3,200			
Menominee	D. F. Poyer Co., Menominee, Mich	¾, 25, $1,125	1, 35, $1,400 1½,35,1,800					
Modern	Bowling Green Motor Truck Co., Bowling Green, Ohio		1, 27, $1,750 1½,32,1,950	2, 36, $2,300				
Moore	Pacific Metal Products Co., Torrence, Cal			2, 32, $2,500			5, 44, $4,500	
Moreland	Moreland Motor Truck Co., Los Angeles, Cal	¾, 23, $1,800	1½,27,$2,050	2½,34,$2,650	3½,34,$3,350		5, 34, $4,000	6½,44,$4,500
Natco	National Motor Truck Co., Bay City, Mich		1, 25, $1,925					
Nelson & LeMoon	Nelson & LeMoon, Chicago, Ill		1, 30, $1,800	2, 35, $2,250	3, 40, $2,750			
New York	Tegetmeier & Riepe Co., New York City		1½,32,$1,800					
Old Hickory	Kentucky Wagon Mfg. Co., Louisville, Ky		1½, $2,000					
Old Reliable	Old Reliable Motor Truck Co., Chicago, Ill		1½,25,$2,250	2, 35, $2,750	3, 35, $3,400	4, 45, $4,000	5, 45, $4,500	7, 50, $6,000
Overland	Willys Overland Co., Toledo, Ohio	⅝, 30, $850						
Packard	Packard Motor Car Co., Detroit, Mich			2, 26, $2,000	3, 32, $3,400		5, 40, $4,150	
Palmer	Palmer-Meyer Motor Car Co., St. Louis, Mo		1, 30, $1,600	2, 35, $2,250				
Palmer-Moore	Palmer-Moore Co., Syracuse, N. Y		1, 32, $1,350					
Peerless	Peerless Motor Car Co., Cleveland, Ohio				3, 33, $3,750	4, 33, $4,000	5, 33, $4,500	6, 33, $5,000
Pierce Arrow	Pierce Arrow Motor Car Co., Buffalo, N. Y			2, 26, $3,000			5, 38, $4,500	
Reo	Reo Motor Truck Co., Lansing, Mich			2, 27,				
Republic	Republic Motor Truck Co., Alma, Mich	¾, 25, $995	1,35,$1,350 1½,35,1,475					
Robinson	Robinson Motor Truck Co., Minneapolis, Minn			2, 36, $2,500	3½,45,$3,400		5, 50, $3,800	
Roland	Roland Gas-Electric Vehicle Co., New York City		1½,30,$2,000		3½,45,$3,500			
Rowe	Rowe Motor Manufacturing Co., Downingtown, Pa		1½,32,$2,450	2, 40, $2,800	3, 48, $3,400		5, 48, $4,500	
Royal	Royal Motor Truck Company of New York, Brooklyn, N. Y				3½,36,$3,400		5, 40, $4,500	
Sandow	Sandow Truck Co., Chicago, Ill		1, 30, $1,800	2, 35, $2,350	3, 45, $3,000	4, 45. $3.600		
Sanford	Sanford Motor Truck Co., Syracuse, N. Y			2, 26, $2,000				
Schacht	G. A. Schacht Motor Truck Co., Cincinnati, Ohio			2, 40, $2,800	3, 40, $3,200			
Selden	Selden Motor Vehicle Co., Rochester, N. Y		1½,20,$2,000					
Service	Service Motor Truck Co., Wabash, Ind		1, 22, $2,000	2, 27, $2,500	3, 30, $2,975		5, 40, $4,000	
Siebert	The Shop of Siebert, Toledo, Ohio	¾, 22, $1,250						
Signal	Signal Motor Truck Co., Detroit, Mich		1, 23, $1,400 1½,23,1,700					
Smith	A. O. Smith Co., Milwaukee, Wis				3, $3,500	4, $3,750		6, $4,750
South Bend	South Bend Motor Car Works, South Bend, Ind		1½,30,$1,750	2, 40, $1,850	3, 80, $2,850		5, 95, $3,250	10,120,$5,000
Speedwell	Speedwell Motor Car Co., Dayton, Ohio			2, 30, $2,850		4, 50, $3,850		6, 50, $4,500
Standard	Standard Motor Truck Co., Detroit, Mich				3, 45, $2,750		5, 45, $3,300	
Steele	W. M. Steele, Worcester, Mass			2, 30, $2,500	3, 40, $3,000	4, 40, $3,500	5, 40, $4,000	
Stegeman	Stegeman Motor Car Co., Milwaukee, Wis	¾, 30, $1,600	1½,30,$2,100	2½,35,$2.800	3½,45,$3,350		5, 50, $4,200	
Sterling	Sterling Motor Truck Co., Milwaukee, Wis	½, 20, $850		2, 23, $2,800	3, 29, $3.400		5, 37, $4,500	7, 40, $4,750
Stewart	Stewart Motor Corporation, Buffalo, N. Y	¾, 30, $1,500						
Studebaker	Studebaker Corporation of America, Detroit. Mich	¾, $985						
Sullivan	Sullivan Motor Car Co., Rochester, N. Y		1½,25,$1,600					
Tiffin	Tiffin Wagon Co., Tiffin, Ohio	¾, 25, $1,600	1, 30, $2,000	2, 35, $2,700				
Transit	Transit Motor Truck Co., Louisville, Ky		1, 30, $2,000	2, 35, $2,850	3½,45,$3,500		5, 45, $4,500	
Twin City	Brasie Motor Car Co., Minneapolis, Minn	¼, 16, $450		2, 30, $1,350				
Velie	Velie Motor Vehicle Co., Moline, Ill		1, 40, $2,000	2½,45,$2,850		4, 45, $3,350	5, 45, $3,750	
Victor	Clover Leaf Milling Co., Buffalo, N. Y		1½,30,$2,250		3, 40, $3,400		5, 50, $3,850	
Vim	Touraine Co., Philadelphia, Pa	½, 20. $620						
Vixen	Davis Manufacturing Co., Milwaukee, Wis	⅛, 14, $395						
Vulcan	Driggs-Seabury Ordnance Corporation, Sharon, Pa			2, 30, $2,750	3, 30, $3,250	4, 30, $4,000	5, 30, $4,500	7, 30, $6,000
Wade	Wade Commercial Car Co., Holly, Mich	¼, 10, $300						
Walter (Truck & Tractor)	Walter Motor Truck Co., New York City						5, 40, $4.500	12, 40,$4,500
White	White Company, Cleveland, Ohio	¾, 30, $2,250	1½,30,$3,150		3, 30, $3,850		5, 40, $4,700	
Wichita	Wichita Falls Motor Co., Wichita Falls, Tex		1, 30. $1,650	2, 35, $2,100	3½,50,$3,250			
Wilcox Trux	H. E. Wilcox Motor Co., Minneapolis, Minn	½, 28, $1,000	1, 30, $2,000	2, 35, $2,500	3, 40, $3,250			
Willet	Willet Engine and Truck Co., Inc. Buffalo. N. Y	¾, 30, $1,600	1, 30, $1,850	2, 35, $2,600	3, 40, $2,800			
Willys-Utility	Gramm Motor Truck Co., Lima, Ohio	¾, 30, $1,350						
Wisconsin	Wisconsin Motor Truck Works, Baraboo, Wis	¾, 30, $1,500	1½,35,$1,700	2, 40, $2,000				

Reference Table of Electric Commercial Vehicles

In the tonnage columns of the following table, the first figure indicates the tons capacity of the truck at the price given. As in the Gasoline Commercial Vehicle list, the prices are mostly for chassis only. Bodies are constructed to order, to suit the class of goods to be handled.

Name of Vehicle	Name and Address of Manufacturer	Tons Capacity and Price						
		Under 1 ton	1 - 1½	2 - 2½	3 - 3½	4	5	6 and over
American-Argo	American Electric Car Co., Saginaw, Mich	½, $1,575	1, $1,720					
Baker	Baker Motor Vehicle Co., Cleveland, O	½, $1,900	1, $2,300	2, $2,800	3½, $3,500		5, $3,850	
Buffalo	Buffalo Electric Vehicle Co., Buffalo, N. Y		1, $2,400					
Couple Gear	Couple Gear Freight Wheel Co., Grand Rapids, Mich	(Front (Four	wheel Driv wheel Driv	e) e)	3, $3,500 3½, $4,400		5, $4,000 5, $5,000	
C. T.	Commercial Truck Company of America, Philadelphia, Pa	½, $1,640	1, $2,095	2, $2,725	3½, $3,530		5, $3,935	7, $4,435
Detroit	Anderson Electric Car Co., Detroit, Mich			2, $2,200				
Doyle	J. C. Doyle, Seattle, Wash		1½, $2,350					
Eldridge	Eldridge Manufacturing Co., Boston, Mass			2, $3,000	3, $3,250	4, $3,500	5, $3,750	6, $3,950
Electruck	Los Angeles Creamery Auto and Machine Works, Los Angeles, Cal	¾, $2,900	(Special body	for milk deli	very.)			
G. M. C	General Motors Truck Co., Pontiac, Mich	½, $1,200	1, $1,300	2, $1,650	3, $1,900	4, $2,100	5, $2,350	6, $2,500
G. V	General Vehicle Co., Long Island City, N. Y	½, $1,700	1, $2,100	2, $2,600	3½, $3,250		5, $3,700	
Old Hickory	Kentucky Wagon Mfg. Co., Louisville, Ky		1, $2,000					
Roland	Roland Gas-Electric Vehicle Corporation, New York City		1, $2,000		3, 3½, $3,500			
S. G. S	S. G. Schorpflin Co., Buffalo, N. Y	¾, $1,600						
Urban	Kentucky Wagon Mfg. Co., Louisville, Ky	¾, $1,560	1½, $1,920	2½, $2,530		4, $3,080		
Walker	Walker Vehicle Co., Chicago, Ill	½,	1,	2,	3,	4,		
Ward	Ward Motor Vehicle Co., Mt. Vernon, N. Y	⅜, $875 ½, $1,250	1, $1,500	2, $1,900	3½, $2,450		5, $2,950	
Waverley	Waverley Co., Indianapolis, Ind	½, $1,800	1, $2,150	2, $3,000	3½, $3,400		5, $3,950	

Burton Process of "Cracking" to Make Gasoline

(*Concluded from page 5.*)

Mr. Burton puts his valve *beyond* the condenser, so that pressure is applied not only to the liquids in the still but to the gases condensing in the coil.

In using the apparatus, there is introduced into the still a quantity of the residual portion of the paraffine series of petroleum distillation—let us say the distillate known as fuel oil, which has a boiling point of upward of 500 deg. Fahr. The valve is normally closed. Heat from the fire-chamber distills the volatile constituents and the resultant vapor courses through the pipe and soil, in which they are condensed. With the valve tightly closed against the escape of the products of condensation, the vapors of distillation accumulate and exert a high pressure, from 4 to 5 atmospheres, upon the liquid in the still, raising the boiling point from 500 or 600 deg. Fahr. to 700-800 deg. Fahr. This pressure of the vapors combined with their contained heat converts high boiling members of the paraffine series into low boiling members of the same series. The valve is opened from time to time to draw off the products of condensation into the receiver. The intervals of drawing off are sufficiently frequent to avoid filling the coil with liquid. In the meantime the relief valve is occasionally opened to relieve gas pressure near the lower end of the coil, which is otherwise likely to obstruct operations.

The resultant gasoline is a product belonging to the paraffine series, the same as the petroleum residue from which it was distilled. Mr. Burton makes no attempt to account for the effect of the back pressure from the extreme end of the condensed coil upon the contents of the holder in preventing transformation of the paraffine series into the objectionable ethylene series, but it is the fact that such effect ensues.

This method of distillation is continued until what is left is a thin, syrup-like residue, marking the limit of the Burton process when first patented. It has, however, been greatly improved since then. In the recently perfected process the residue is taken to a second still of ordinary construction, there to be subjected to heat at approximately atmospheric pressure until nothing is left in the still but a solid residue. The liquid product of this distillation is reintroduced into the first still, mixed with a new charge of the original fuel oil character, there to be again distilled under pressure.

The yields of finished gasoline that can be obtained by this process vary widely with the character of the so-called fuel oil, which is used as a raw material. Oils derived from crude oil from one section of the world give much better results than oils derived from other sections. Some oils will give a yield of around 60 per cent of crude gasoline distillate, while others will not give so much.

The oil secured by redistilling the products from the original distillation are more refractory than what might be called "fresh" stock. It is therefore impossible to give definite figures as regards yields, but in a broad, general way it might be stated that the process in question will at least double the yield of finished gasoline products from a given crude oil.

It should be understood that the gasoline distillate thus produced, while usable in internal combustion engines, is not a deodorized product. To render it such requires redistillation and sulphuric acid treatments.

It is perhaps too early to say what this process will mean to the commercial world or how it will affect the prices of gasoline. Mr. Burton's first patent on this process was issued January 7th, 1913, and the second, making use of the 35 per cent residue from the first "cracking," was issued August 4th, 1914. The fact that the Standard Oil Company is using the process in a plant built for the purpose is evidence of its commercial and practical utility as well as of its scientific interest. Logically, if the process itself is as cheap and economical as it appears to be, the coming increase of consumption of gasoline, by the thousands of new automobiles and other calls for "motor spirit," is already met with a means for making several cobblestones out of one rock—several gallons of gasoline where only one grew before.

Military Tactics and the Motor

(*Concluded from page 9.*)

and miles in the rear of the battle line, as far beyond the range of heavy artillery fire as possible. Connection with the firing line is maintained by telephone and by motorcycle dispatch riders. In fact, the latter are pressing the automobiles hard for honors in this field.

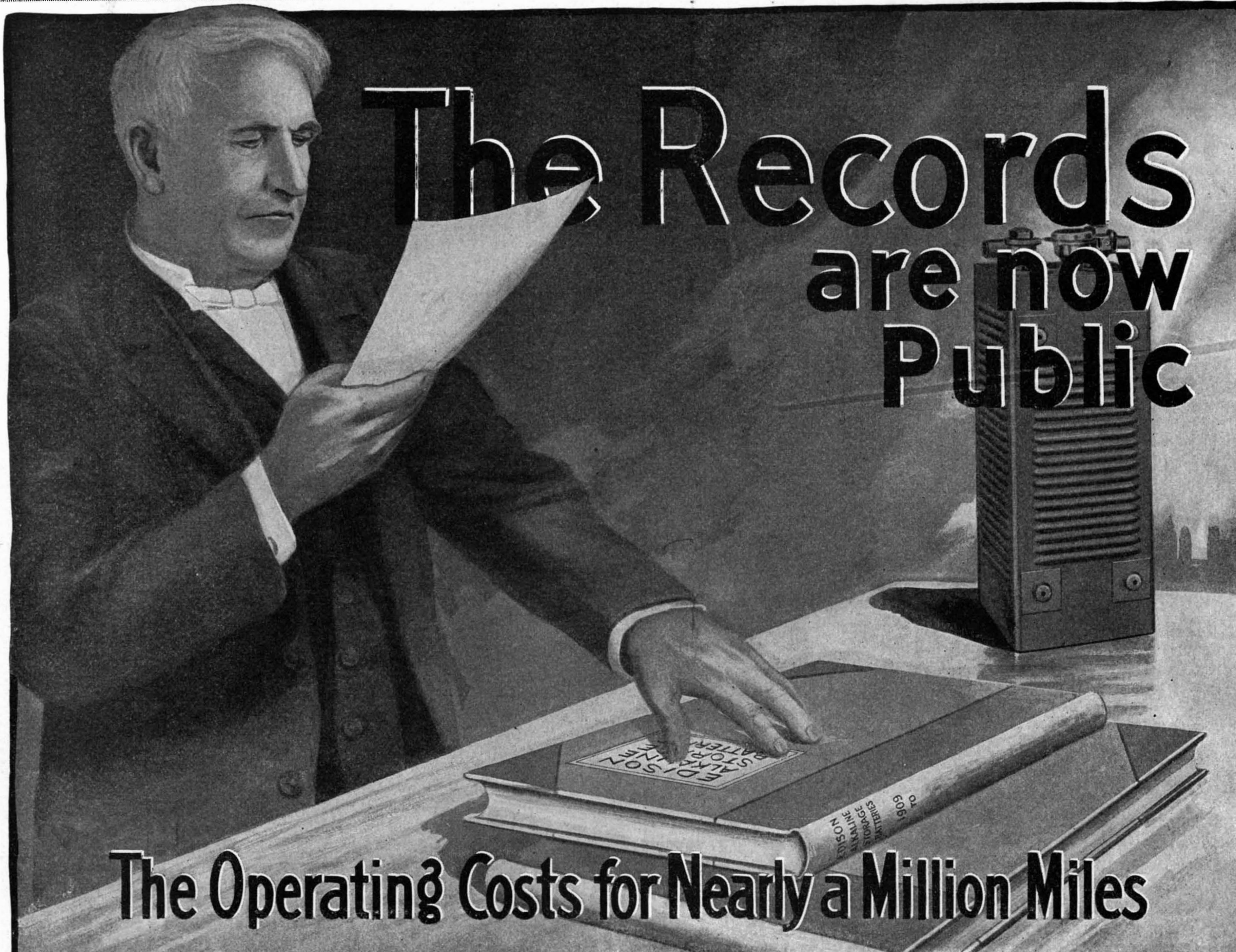
It is getting dark. A fog seems to settle over the battlefield, the smoke from burning farm houses, haystacks, and—well, and "other things"—hangs like a pall over everything. Suddenly a sputtering motorcycle flashes past at a speed of more than a mile a minute. In the continuous crackling of small guns and rifles the noise of the racing motorcycle is almost lost. Peering with eyes strained to the point of tears into the dim light ahead, his sharp electric horn screeching an alarm forward, the rider flashes by, at every instant of his ride flirting with death, because of the darkness ahead. Suddenly he shuts off the gas and slams down the brake with all his power. He just manages to stop as his front wheel touches the rear of a convoy truck going slowly to the rear. Past the truck, ordering the driver to stick farther to the right of the road, he goes, and soon he finds "his" truck detachment. An order to the driver in charge, and the whole convoy starts for the battle lines. The motorcyclist acts as guide, so as to insure quick delivery of the ammunition needed at such and such a place. Each regiment has one or two such dispatch riders ready at all times. They sometimes get no real rest for days at a time, snatching a bit of sleep after having fetched one convoy to the point needed.

The ammunition column thunders past the watcher on the roadside. Powerful gasoline trucks, driven without any regard to efficiency or economy of operation—solely with the idea of getting there, and getting there as quick as the roads will permit. Hardly has the column reached its destination when an urgent request is received by the commanding general for reinforcements to a certain danger point. The telephone carries the message to a motor column in the rear, and fifty motor buses, tractors with two and three trailers, all loaded to capacity, rush forward. Three additional regiments reach the point of danger within a fraction of the time it would have taken an old-fashioned "orderly" to gallop to the commanding general on the well-known "hill overlooking the battlefield." The "hill" in this case happens to be a captive balloon fully 3,000 feet above the trenches.

A lull in the bombardment. Wounded are picked up by the sanitary corps and carried to certain collection points in the rear of the trenches. Every little while motor ambulances call at these points and carry away those whom it has been possible to save under the artillery attack. The motor ambulances, in the case of the French armies, go back to cities in which facilities for the treatment of the wounded can be found, while in the case of the German armies well equipped hospital trains of twenty-five to thirty coaches wait at some convenient gathering point behind the battle line, to which point the motor ambulances carry their loads.

Steam Tractors.

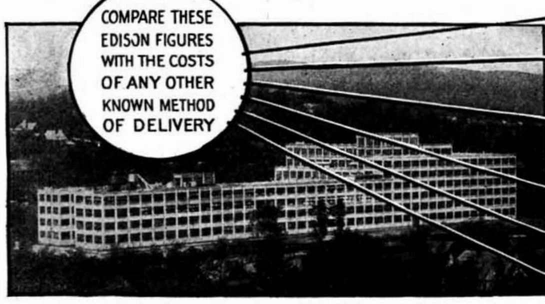
One of the surprises of the British expeditionary forces has been the excellent showing of the fleet of 110 Foden steam trucks as heavy tractors. For slow haulage of three and more trailers, of heavy artillery, and as repair wagons with complete electrical equipment, these steam trucks have given invaluable service. They are easily kept in repair and they burn small anthracite coal as well as crude oil and kerosene. In the first batch of steam trucks there was considerable difficulty about fuel, and a whole column came near being wrecked because of the



I CLAIMED that the **New Alkaline Storage Battery** would make the Electric Vehicle the cheapest means of Street Transportation, but I had only my private tests to satisfy me. Today thousands of Edison Batteries in thousands of Trucks and Delivery Wagons are making Operating Records that are easily investigated by all. After the four or five years of hard service that many of these vehicles have had, is it possible to deny that my claim is proved?

Thomas A. Edison

HERE IS ONE RECORD—A REPORT—ON 22 FIVE-YEAR-OLD EDISON BATTERIES



The Edison Storage Battery Plant at Orange, N. J., was not affected by the fire in the Edison Phonograph Works on December 9th

Write for Bulletins on the use of **Edison Batteries** for Lighting Country Houses, Ignition and Lighting of Gasoline Cars, Yacht Lighting, Railway Train Lighting and Signaling, Telephone, Telegraph and Wireless *and High-priced or Low-priced Passenger Electrics*

Edison Storage Battery Company

Orange, New Jersey

Distributors in New York Chicago Boston Cleveland Washington San Francisco Los Angeles Portland, Oregon Seattle

ADAMS EXPRESS COMPANY

242 WEST 47TH STREET

MOTOR VEHICLE DEPARTMENT
GEORGE STEVENS
SUPERINTENDENT

NEW YORK. December 7th 1914

Edison Storage Battery Company,
Orange, N. J.

Attention of
R. A. Bachman,
V.P.& Genl Mngr.

Gentlemen:-

Thank you for consenting to extend from five to six years the conditions of your guarantee regarding renewal of positive plates.

The average operating cost per battery per month of the twenty-two trucks at Indianapolis, equipped with Edison Batteries in November 1909 and averaging about 660 miles per month, is as follows:-

YEAR	BATTERY MAINTENANCE (Refilling, new solution, watering, cleaning, all repairs, inspection, etc.) Material	Labor	CURRENT (Purchased by meter)	TOTAL
1910	$3.47	$4.10	$10.05	$17.62
1911	3.41	4.10	8.93	16.44
1912	3.41	4.10	9.90	17.41
1913	2.86	4.10	8.17	15.13
1914 (to Oct.31)	3.11	4.10	9.50	16.17

The average total operating cost per battery per month has, therefore, been $16.55 for a period of five years. In this time the average mileage per truck was about 40,000, which reduces the operating cost to $.02½ per mile. The batteries are still in service.

Yours very truly,

Geo. Stevens.
Superintendent

GS*HHW

dense columns of smoke given off by the steam wagons. The German artillery, more than seven miles away, got the range of the smoke column and big shells dropped amid the convoy, wrecking three of the Fodens and damaging others severely before the trouble with the fuel could be remedied. Besides the big fleet of 110 Fodens, there are about 80 other steam trucks, of four different makes, in use behind the battle lines. For slow, heavy tractor work the steamers are preferred to the 50 and 100 horse-power gasoline trucks. Generally a complete fleet of steam wagons consists of about thirty vehicles, including a few trailers, a repair wagon, a 1,000-gallon water tank wagon with high speed pump installation, stores and equipment sufficient to make the entire fleet self-sustaining for six months under war conditions. The personnel of such a fleet consists of one officer, sixteen non-commissioned officers, sixty drivers, five mechanics, two boilermakers, two smiths, two wheelwrights, two motorcycle orderlies, and one cook.

The driver of one of the heavy trucks, in a letter to his folk, complains that he never knows where he is going. He says that a motorcyclist precedes the first truck of a column, and the driver of that truck has orders to follow the cyclist. The other drivers, of course, "follow the leader." On one occasion the whole convoy made a rush trip which lasted, with few stops, three whole days.

Signal Troubles.

The old-fashioned signal "halt" called by a sentry on the roadside probably will have to be amended in some way. On numerous occasions drivers of motor trucks, motorcycles and swift touring cars have dodged death by a hair's breadth. A dozen or so are reported to have been killed because of the old-fashioned "halt" shouted by a soldier. The sputtering motor downs the call, and the first intimation the driver of a car gets that anything is wrong is a rifle bullet singing past his head. Complaints from drivers have caused a change in the challenging along some of the most frequently used roads. A red lantern is waved, and if the driver does not stop instantly there's apt to be a vacancy on that particular truck.

Far-reaching Accidents.

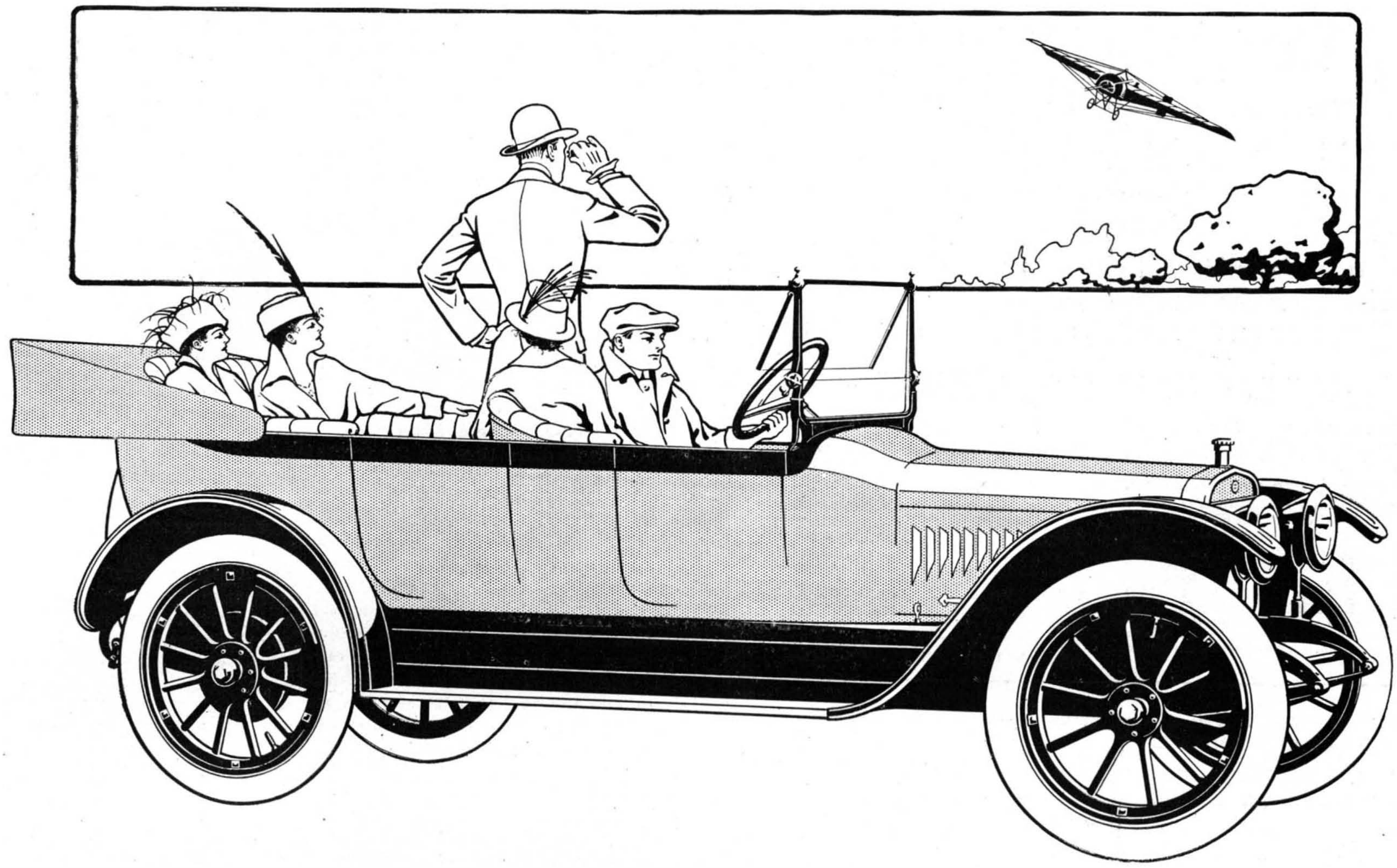
On what slight chances the safety of a whole army sometimes depends was shown in the early part of September during a retreat of a French division to another fortified position. There was only a single road of medium width, along which the swift retreat was made. A desperate attack of the Germans in greatly superior numbers was launched at this point, and the whole division took to the motors for rapid withdrawal. At the high speed made, one of the big trucks near the head of the column skidded and upset, pitching its load of heavy cases of ammunition into the road and blocking it completely for all vehicles. It took forty-five minutes to clear the *débris*, and in that time the German artillery dropped hundreds of shells into the surging mass on the road. Fourteen heavy trucks had to be abandoned, after having been rendered useless by removal of important parts. Almost a thousand men were killed and three times that number wounded—all because a truck skidded at the wrong time!

In another case reported from Belgium, a motorcycle orderly guiding an ammunition train to its destination was struck by a small piece of shrapnel in such a manner as to make him lose control of the wheel. He crashed into a tree on the wayside and was knocked unconscious. The accident happened shortly before a crossroad point, and the motor column attempted to go ahead without the guide. The wrong road was chosen, and the column brought up a half hour later at the field kitchen station belonging to another army corps. Nearly ten miles away a regiment was out of ammunition and had to withstand a withering fire from the enemy without being able to reply effectively.

The Rubber Tire Problem.

Except on the fast cars used by the officers, pneumatic tires are strictly tabooed. Even on motor ambulances the solid rub-

A TOTALLY NEW WINTON SIX



AT A NEW PRICE–$2285

Excelling quality—never before produced except in the biggest and most costly cars—is now, *for the first time,* obtainable in a car "not quite so big"—and at a price hitherto impossible:—The New-Size Winton Six at $2285.

This car gives you everything that makes an automobile high-grade, good to look at, delightful to use, and creditable to own—even to that final note of quality, your own personally selected color scheme.

Here are Some of its Major Features:

Motor—The famous Winton Six-Cylinder L-head motor. Bore, 3⅝ inches. Long stroke, 5¼ inches. Ratio of stroke to bore, 1.44 to 1. Big valves. Spark plugs in head. Fly wheel, crank-shaft, pistons, and connecting rods balanced. Crank-case divided into upper and lower halves. Motor, clutch, and transmission in unit power plant, completely housed.

Wheel Base—128 inches; eight inches shorter than the Model 21 Winton Six.

Electric Features—Bijur starting and lighting system with separate motor, generator, and storage battery. Head, signal, tail, and dash lights. Bosch ignition.

Carburetor—Rayfield, special type. Dash control. Primer on cowl board.

Fuel System—Seamless gasoline tank of 21½-gallon capacity at rear of frame. Gasoline carried by air pressure to auxiliary tank under cowl; flows by gravity to carburetor. Cleanest and safest system. Main tank has gasoline gage.

Lubrication—Oil circulation by means of gear pump in crank-case. Practically infallible; a system that has made the Winton Six the best lubricated motor in the world.

Cooling—Honeycomb type radiator of large capacity. Cylinders fully water-jacketed. Gear-driven centrifugal circulating pump. Radiator fan.

Clutch—Five-pair dry-plate clutch. Highly effective in operation, and easily controlled.

Transmission—Selective sliding gears; four ahead and one reverse. Direct drive on third. Lockout on reverse.

Steering—Left-hand drive, with center control. Worm and gear steering mechanism. Self-lubricating bushings.

Drive—Drive shaft has internally lubricated universal joint at each end. Spiral bevel gears in rear axle.

Axles—Elliott type drop-forged front axle. Full floating type rear axle.

Springs—Chrome vanadium steel springs. Semi-elliptical front. Three-quarter elliptical rear. Rear springs underslung. Dann oil-cushionized inserts in all springs. Resilient and squeakless.

Wheels—Wood or wire wheels at purchaser's option. All wheels run on Timken roller bearings.

Brakes—Two contracting and two expanding brakes of liberal size, all on rear axle.

Tires and Rims—36 by 4½ inch tires on all wheels. Non-skid tires on rear wheels. Firestone demountable rims.

Tire Inflation—Motor-driven air pump provides pressure for tire inflation.

Accessibility—To make all working parts quickly accessible has always been the Winton policy. That policy has been thoroly observed in this model.

Body—The American Beauty type, a creation that makes this a genuine *pleasure* car. Especially graceful in design, and the last word in comfort. Divided front seats without extra charge, if you desire them. Spacious doors on concealed hinges. Finest of coach leather. Information upon request about roadster, coupe, limousine, and other bodies.

Top—One-man top of silk mohair, with handy Jiffy curtains that are put up or taken down without alighting from the car. Top attached to glass front.

Wind Shield—Handsome and sturdy. Fine plate glass. Both sections adjustable; upper for rain vision, lower for ventilation.

Equipment—In addition to features named above, the equipment includes Warner speedometer, clock, and Klaxon horn. Latter is carried out of sight, under the bonnet. Horn button in center of steering wheel.

Colors—To avoid the monotony of cars that lack distinction and individuality, we permit the widest range of color schemes on this car. Each buyer may have his car finished to suit his individual taste. Metal parts trimmed in nickel.

Service—Buyers of this car will be entitled to the same thoro gratuitous service that is extended to buyers of the Model 21 Winton Six. That means continuous satisfaction.

Price—This car, which we term the Model 21A, sells at $2285, f. o. b. Cleveland.

Completely descriptive catalog upon request

The Winton Motor Car Co.

The World's First Maker of Sixes Exclusively

1080 Berea Road, Cleveland, Ohio, U.S.A.

MOTOR CAR RESOURCES.*

Type of Motor Car	Great Britain	France	Russia	Belgium	Servia	Germany	Austria-Hungary	Turkey
Armored Cars........	500	500	200	50	....	1,000	300	100
Subsidized Trucks....	....	1,200	300	....	....	1,400	600	....
Other Heavy Trucks..	18,000	15,000	500	200	50	15,000	3,000	300
Gun Tractors........	150	300	....	....	....	500	200	....
Touring Cars Available.	250,000	95,000	15,000	10,000	100	60,000	20,000	500
Special Army Vehicles.	....	300	100	50	....	1,000	500	....

* These figures have been compiled from the latest available official statistics, combined with estimated new production by companies under military control; estimated waste of the first four months of the war, calculated on the basis of 30 per cent of the total in use in September; and the reported supplies of British cars to Russia and American cars and trucks to Great Britain, Russia and France. The figures make no claim of absolute correctness, but are merely as close estimates as an "outsider" is able to make at this time. They cannot be far out of the way.

ber tire is preferred, because of the immense trouble caused by bullets or shrapnel penetrating the pneumatic—usually at the most inopportune moment. On some of the British armored cars twin pneumatics are used on the rear wheels, but in the majority of cases solid tires have been mounted. Safety in this case is preferred to a certain degree of comfort.

In one of the dispatches sent by Gen. French to the British government, emphasis is laid on the necessity of having enough spare tires for all sizes of wheels. A whole fleet of trucks had to be abandoned and scrapped during the wild scramble across northern France because there were no extra tires for the trucks! Motor truck experts now at the front calculate the destruction of vehicles at about 60 per cent of the total, figuring that not more than 40 per cent of the motor trucks sent to the front will ever return in condition to be useful for anything else. The estimate of the British is slightly higher, reaching nearly 70 per cent, while that of the Germans is less than 50 per cent. Several hundred good British and more than a thousand French and Belgian trucks are reported to have been repaired by the Germans in the big F. N. and Minerva automobile factories in Belgium. The Minerva plant, especially, has proven of great value to the invading army, because of its location at Antwerp, so near the scenes of fighting.

Special Equipment.

Among the special types of vehicles employed in the campaign are a number of 200 horse-power motor plows which dig trenches three feet deep faster than a hundred men can dig them with spades. Huge steam tractors with regular roller wheels for smoothing roads are used for pulling the heaviest weights, while caterpillar tractors, of the type made in Iowa and Illinois, pull the heaviest siege guns.

Searchlight wagons are used extensively, some with acetylene and some with electric lights; powerful trucks equipped with electric dynamos for charging wire entanglements with high-voltage electricity; aeroplane towing and repair wagons; swift, small mail delivery wagons, "cyklonettes" on the German side; light four-wheelers on the side of the Allies.

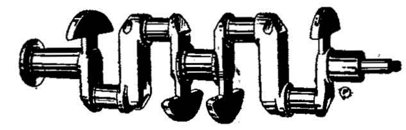
Military tactics to-day may be said to rely pre-eminently on the motor and its speed. Attacks reaching forward at the rate of thirty miles a day are no novelty in 1915. Retreats, in complete order, at a speed of fifty miles a day would have been called impossible by military men twenty years ago. The motorcar has revolutionized warfare. In its complete destruction of all the lore of centuries regarding military tactics it has proved as ruthless as the much talked of 42-centimeter siege gun of the Germans has to the fortresses of the past century.

The Car of 1915

(Concluded from page 10.)

of counter-balancing his crankshafts. This lightening and balancing has come as a matter of course, for it is absolutely essential in view of the higher piston speed of the modern motor.

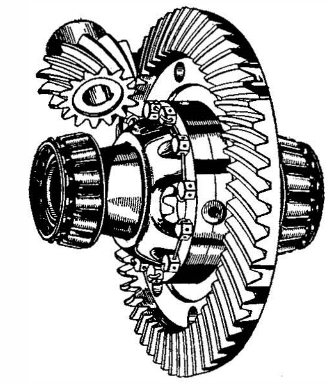
In gearsets, not a great deal of change is noticeable; it is significant of changes that may come, however, that one maker has adopted a type in which all gears not in use remain idle and not idly rotating, as is the more usual custom. This, of course, reduces both power waste and wear, and may, therefore, be looked upon as commendable. Disk and cone clutches hold about their accustomed places in popular esteem, but there has been a notable change in propeller shafts. In quite a number of cases, these now are tubular instead of solid. Hence, they are at once lighter, stiffer and less liable to the whipping which may constitute a grave evil



Counterbalanced crankshaft.

in some of the modern long wheelbase vehicles.

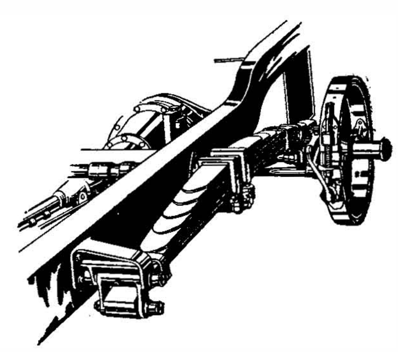
In methods of final drive, the worm scarcely has made any advance, though one maker has adopted it during the year. In the commercial vehicle and electric passenger vehicle fields, however, it steadily is coming into more extensive use. But in the gasoline pleasure vehicle field the combination worm and bevel gear, or, as it is styled, the spiral bevel gear, answers practically all of the requirements of the worm gear, but offers few if any



Spiral bevel gear.

of its disadvantages in the way of manufacturing difficulties and mounting problems.

Still another place where the promise of last year has been lived up to is in the spring suspension. The cantilever type of spring, which last year first became at all common when a number of makers adopted it all at once, has become still more common and now has taken a firmly intrenched place in the industry. Its de-



The cantilever spring.

monstrated efficiency, coupled with the worthy fact that it costs less than other systems using more material to obtain a similar result, has brought it to the attention of the industry.

These are some of the things that distinguish the car of 1915 from the car of 1914, though they are not all. They are a following out of the various tendencies which made themselves apparent a year ago at this time. They are nearly all *little* changes for the better, and their very smallness, when taken each by itself apart, compels the conclusion that we may no longer look for big, revolutionary changes in an industry so well founded on sound engineering principles.

The High Speed Automobile Motor

(*Concluded from page 11.*)

discriminating selection of materials, and the very highest grade of engineering skill and workmanship throughout.

It is this very high standard of manufacturing required, combined with the old, long-recognized dislike of Americans for high speed motors, which makes automobile builders hesitate about adopting them as a regular feature. The Frenchman, with small output and skilled hand labor, can maintain this required standard without much difficulty, but to accomplish it on the scale of the American factory output is a far different thing and calls for much preliminary work and experiment before it can be safely launched upon the market.

As regards the four principal features which must be considered in the manufacture of the high speed motor, that of suitable valve mechanism is probably the most important as well as the most vexing problem confronting the engineer at the present stage of development. In fact, it is undoubtedly true that this type of motor really waits at present upon the satisfactory solution of the valve mechanism more than anything else from an engineering standpoint.

We are in the midst of the melting pot era on valve design, when every conceivable type of mechanism from modified poppet style to so-called sleeve, rotary and piston types is being experimented with, adopted, or advocated. There is much confusion of ideas among engineers as to the relative merits of each, because all types have not been tested enough yet under actual service conditions, and particularly under high speed requirements, to promote confidence as to their thorough practicability. Furthermore, the introduction of the sleeve, rotary and piston valve types complicates the matter by the direct relation they have had upon the lubrication problem. If such valve mechanisms are adopted a delicate adjustment of lubrication must be provided to prevent excess accumulation of oil on the ports at slow speeds and oil starvation at high speeds. The range of motor speed being greater, the difficulty of such lubrication is much increased over that encountered on relatively slower-speeded motors.

The ordinary poppet type of valve affords a much simpler problem as regards lubrication, but has two serious drawbacks for high speed use. One of these is its smaller relative port area, which tends to cause strangulation of the entering charge as well as of the exhaust gases, and hence reduces efficiency. The other is the risk of actual fracture of the valve stem and consequently serious motor damage due to the terrific hammering action of this style of valve. This type is also more difficult to keep in adjustment on high speed work. Few people realize how great this strain is in poppet valve action. At a speed of 2,000 revolutions per minute of the motor of four-cylinder design each valve must be jerked from its seat, raised, say, ½ inch, and dropped again through the same distance one thousand times in a minute. The actual time used for the complete opening and closing of the valve is of course only a fraction of a second, and it is this high frequency of successive hammer blows which finally causes rupture of the valve stem, even though the blows are small relatively in intensity. Also the alternate heating and cooling of the valves, particularly of the exhaust valve, has a deteriorating effect upon the strength of the latter and hence shortens its life. These two valve destroyers have their most powerful effect in the high speed motor on account of its extreme properties in all directions, and it is therefore easily apparent why the valve mechanism must be very carefully worked out and given a most searching test before adoption as a standard product.

It is of course only a matter of time before a thoroughly satisfactory valve mechanism will be developed for this style of motor and combined with an efficient oiling system, but until these two vital features are satisfactorily disposed of we are not likely to see any extensive manufacture of this type of engine, however desirable it may be.

The matter of balance has already been pretty thoroughly met and the rules to be followed are more or less generally understood by all automobile engineers. The introduction of forged steel piston rods of very uniform size and light weight as well as of composite aluminium pistons has considerably simplified this problem of late. In high speed work kinetic balance is of very great importance and the old methods of balancing according to static principles are no longer sufficient. For instance, a flywheel when mounted on a shaft and set on knife edges can be balanced statically without great difficulty by merely drilling into the side of the rim of the heavier portion, but this does not give any assurance that the center of gyration will coincide with the axis when it is revolving. To secure a sufficient approximation to the latter ideal condition necessitates a very careful testing of all the revolving and reciprocating parts. Failure to maintain this high standard of balancing practically eliminates the motor from any bid for success in the high speed field, for its balance must be so perfect that its real motor speed cannot be readily detected. The slightest unbalance produces vibration, which in turn attracts the attention of the occupants of the car to the speed of revolution of its motor. To be a real success, the latter must be literally unobtrusive as regards noise and vibration.

Much of the success of the balancing problem depends upon the skill of the designer in proportioning the relative parts and selecting the materials, so that no useless metal is present in the rotating or reciprocating members. The proper combination of strength with lightness in such units as the pistons and connecting rods, crankshafts, etc., is of the utmost importance, and of course the lighter these parts can be made the easier the balancing problem becomes. From the very nature of the design the parts of a high speed motor of equal power to one of much slower relative speed ranges can be made considerably lighter, for the necessary increase in power is obtained by the greater speed of the motor, and the piston and hearing pressures are therefore less.

The common practice of balancing by merely paring off component parts, such as opposed pistons, will not suffice for high speed standards. Such an arrangement is liable to produce a disagreeable fore and aft traveling or periodic vibration along the crankshaft and is a makeshift arrangement at best. Each piece must be weighed, inspected and sorted, with the object of maintaining the duplicate parts of each individual motor at the highest possible standard of uniformity.

The importance of the balancing proposition will call for a considerably higher standard of interchangeability of parts than heretofore, and in fact the repair men will also come in for an increased share of responsibility when it comes to overhauling such motors. It will never do, for instance, to put in an extra large piston in order to stop oil from passing by into the combustion chamber or resort to any other of the numerous tricks familiar to the gentry when attempting to rejuvenate wornout motors. A little careless work of this character would ruin the finest built high speed motor from the balancing standpoint.

When the small, quiet running motor of this type is finally produced, however, on a really successful commercial scale, it bears promise of causing a considerable revolution in motorcar design, the principal effects of which will be in the saving of space and weight and in the matter of economy.

These savings begin with the motor itself, which can be made lighter and very much more compact for a given horsepower output than anything we have been accustomed to. On account of the higher speeds at which it runs, all shafting and gears can be made lighter, and by reason of the shorter wheel base possible from this compact design a still further reduction in weight is secured. This weight reduction proceeds all along the line with

a total amount that will prove a strong inducement to the would-be purchaser who has become tired of the constantly increasing weight of touring cars in recent years. This feature we believe will have a particularly strong appeal when it is further realized that the same power is still available in an even smoother drive than formerly with the slow speed type, and fully as much, if not more, room and comfort. At ordinary car speeds a four-cylinder motor of the high speed type should very closely approximate the smooth torque of the six-cylinder motor and afford a drive entirely free from the objectionable jerking and bucking of the large high-geared four-cylinder type when the latter is throttled down finely. Constant tinkering and tuning up would not be as necessary on this type either, as an occasional skip would scarcely be noticed except when the motor was well loaded down.

Another important feature not often mentioned in analyzing the principal characteristics of the high speed motor is its valuable braking property. Anyone who has ridden in the front seat of a taxicab with the driver must have observed how readily these little cars slow down by merely closing the throttle and leaving the clutch in. The great value of this feature is better appreciated when one considers the simplicity of control afforded by using the throttle for retardation as well as for acceleration. A taxicab driver would be well-nigh exhausted at the end of a day's running if he had to release his clutch and apply either the foot or hand brake every time he slowed down. In the touring car with high speed motor and comparatively low direct drive gearing this motor braking property would be even more pronounced than in the ordinary type of taxicab and would greatly simplify car control particularly for new drivers.

When looked at from all angles it would appear that there already exists a strong under-current of opinion among motorists favorable to the commercial exploitation of the high speed motor type of car; not for the sake of the high speed motor itself, but because of the relief which it seems to promise from the constantly growing burden of weight and increased running expenses. Its successful development, however, must wait the solution of its manufacturing difficulties, and there is evidence that American manufacturers are now working to gradually evolve a motor which will meet these high speed requirements.

How Small Communities May Have Good Roads

(*Concluded from page 15.*)

who have charge of all the public roads, that if the Commercial Club would pay all costs over and above that of drainage and grading, they might proceed as they wished on any piece of road, not to exceed one mile in length. It was decided to select one of the worst sections and improve it as an object lesson of what could be done with available funds and materials. A road expert was secured from the Office of Public Roads to make the detailed plans and supervise the work. As typical of the worst road problem confronting that region, a road was selected which for several months of the year was practically impassable, because of lack of subdrainage. This road was properly drained and surfaced with gravel. So striking and convincing was the object lesson that before the expert had entirely completed the work, the county supervisors were calling for contracts involving the drainage of several thousand feet of road in the vicinity.

A State Department Promotes Co-operation.

In the Blue Ridge Mountains of Virginia, a road 14 miles in length passes through three counties. Eight miles are located in Albemarle, four miles in Augusta, and two miles in Nelson County. This road had long been in need of improvement, but because of the three distinct jurisdictions, no concerted action was reached until the State Highway Department pointed the way. Here was a road in which three counties were vitally interested, the cost of improvement of which would not be less than $7,000 per mile, and furthermore, piecemeal improvement would be of but questionable value. The entire road must be improved as a single unit. The State-aid allotment available that year for each county was set aside for this road with the understanding that the local communities raise the additional funds required. In Albemarle County a portion of the funds was raised by private subscriptions by the citizens and the county appropriated the remainder. In Augusta County the county authorities appropriated the necessary funds, while in Nelson County the entire local fund was raised by popular subscription. The State prepared the necessary plans and supervised the construction. This road was thus built through the co-operation of the State, the counties, and private citizens.

Administrative Organization Essential.

Whether co-operation in road work among smaller communities will be efficient and prove of real and lasting value or but a costly experiment, depends largely on the administrative organization. Haphazard co-operation cannot be too severely condemned. It invites extravagance and is inefficient in the expenditure of labor and funds. It works without system and lacks the proper co-ordination with the larger interests of the county and State. But, on the other hand, properly organized and directed co-operation furnishes a means through which local communities may secure better systems of road management, more efficient returns from their road expenditures, and better roads. This kind of co-operation will give them roads which are adapted not only to their own local needs, but also adapted to meet all the requirements, both present and future, of the county, State, and nation.

War Experiences of an Air Scout

(*Concluded from page 20.*)

siderably faster in speed, and capable of climbing 7,000 feet in fifteen minutes, thus making it a very desirable machine for scouting purposes as well as to give fight to any of the German machines, since some of these machines were equipped with machine guns operated by the passenger, while others were fitted with bomb-dropping devices. It is excellent also for observation work and the dropping of small round, pointed, and grooved iron pencils in quantities of a thousand at a time. The latter proved very efficient when dropped over the enemy on the march or into their trenches.

Off to the Battle Front.

On October 17th I received the long-looked-for order to go to the front in an *escadrille* of six Morane-Saulner monoplanes. That night five other pilots and myself left Tours for Saint Cyr, a few miles outside of Paris, where we found the six Morane-Saulner machines awaiting our arrival the next morning. The six of us visited the captain in charge at Saint Cyr, who ordered us to fly that day to the aviation headquarters near Arras, 150 kilometers from Paris. Maps were furnished us, which we prepared and placed in the map cases which are a part of every machine, as well as a compass, with which every apparatus in France is steered. A flight of ten minutes demonstrated to me that my apparatus was in perfect condition. At one P. M. on the 18th of October the six of us started at a few seconds intervals on our journey. Upon attaining a height of 2,000 meters, the six of us sailed from Saint Cyr toward the point where civilized men were murdering each other, and the fact that it would be but a matter of a few hours ere we would be accomplishing the same purpose with our deadly bombs seemed hardly believable.

The journey, a short one, seemed awfully long to me. Several times, with the aid of field glasses, I could see far below me thousands of soldiers marching toward the battle front. Destroyed bridges over the Oise and Somme rivers showed me ground that had been occupied

by the Germans a few weeks before. After flying for one hour and a half the portable hangars of the temporary aviation headquarters just to the south of Arras appeared visible. A few minutes later I was directly above them. Shutting off the motor I volplaned down in a spiral glide, and a few seconds later was again on *terra firma*. The six of us had made the flight of 150 kilometers without mishap. I was anxious to get into the fray at the earliest possible moment, so I immediately reported to the commanding officer, who appointed a junior officer to accompany me as observer on my flights; the first to be made the following morning at six o'clock.

Patrolling the Sky.

The next morning at six o'clock my observer, who was able to speak good English, and I were up and anxious to fulfill the work that lay before us. A heavy fog was a great disappointment to me and caused a delay in our start. It was at least ten o'clock before the captain would permit us to start away on our flight. Our course had been prearranged, and it was the duty of my observer to make notes of the movements of the enemy's troops. Several other apparatus started away at the same time we did. Rising to a height of 2,250 meters (7,000 feet) I headed the machine toward Douai and thence toward Lens. The flight lasted a little longer than one hour, and proved to be intensely exciting. At times it was impossible to see the earth directly along the line of battle, owing to the terrific cannonading that was going on; the smoke was so dense that it seemed as though we were flying above the clouds. We penetrated the enemy's line for a distance of half a dozen miles, where the actual movement of troops was going on, the data on which was quite important to the French. There appeared vast columns of soldiers that, in the winding roads, seemed like great big snakes crawling slowly along. From our extreme height it was hardly possible to make out the direction the troops were traveling; but after circling over the point for ten minutes, my observer detected with the aid of glasses the direction in which they were heading.

The Death Dealing Arrows.

In one hour of flying the observer who accompanied me had sufficient time to note nearly every action of troops belonging to the enemy that we had flown over; and upon alighting his notes were immediately dispatched to the front. Three bomb-dropping machines and one equipped with several thousand of the sharp-pointed, steel arrows, or pencils, as they are sometimes called, were dispatched to raise havoc with the enemy's troops that were on the march. For this purpose the steel arrows, which are about 4½ inches long, round, and sharp on one end, and grooved out on the other end, prove a very good weapon. They are dropped from the aeroplane while in motion in quantities of 1,000 at a time. They spread out over an area of 300 square feet, and after a fall of say 6,000 feet, they will penetrate almost anything. The French were the first to invent them, and the Germans, seeing their good work through the damage done to their own men, copied them with the following words cast thereon: "Invented in France, but made in Germany."

An Aeroplane Lost.

Of the four machines that started out on their murderous journey to the enemy's lines, one did not return. He suffered the same fate that he and his passenger were dealing out to the Germans below. From one of the other three aviators who had accompanied the unfortunate, I learned that he was a young officer, and being very desirous of making a good showing, had, upon reaching the enemy's line, descended to quite a low level, where he attempted to dispatch with better accuracy the bombs he was carrying. Terrific rifle and machine-gun fire was immediately directed upon his apparatus, which suddenly began to wabble and then plunged head first down to a horrible death. Both the pilot and passenger must have been instantly killed, and the horror of having seen his fellow pilot killed

drove my informant nearly insane. I learned that the loss of life among the aviators at this particular line of battle front had been quite severe, and averaged about two a week since the war began.

Not having been ordered to do any flying that afternoon, I visited one of the battlefields in the vicinity, where fighting had taken place weeks before. I should have liked to visit the present point of fighting, but permission was refused me, as all aviators must remain, both day and night, at their headquarters, and see that their apparatus is always in a flying condition, in order to be ready to move at a moment's notice, should the commander receive orders from the front to advance or retreat.

(*To be continued.*)

American Automobile Coachwork

(*Concluded from page 21.*)

is given in Fig. 5. When it is desired to open the car the top folds back with little overhang. The windows drop into pockets and are not taken out and put behind the driver's seat with a moral certainty of breakage sooner or later. This particular body has only two doors, but the four-door type is even more popular. The V-front is a feature which might well be copied here on bodies of types other than the cabriolet.

Fig. 6 represents a type of town carriage, also of English make, but French design, in which the comfort of the driver is not considered. The addition of a windshield and top would completely alter the character of the body. The toolbox in the middle of the running board, although countersunk, does not enhance the beauty of the car.

In Fig. 7 is seen a touring body by an American coachbuilder. The top disappears completely into the body, there being no visible casing. Unfortunately with this type of top a dust screen is often necessary, thus spoiling the very effect obtained after much expenditure of ingenuity.

The subject of Fig. 8, although of the same general type as the preceding example, is much less successful. If the sidelights were set in the cowl, the front door widened to the size of the rear one and the outlines of both changed, and if the top cover were neater, the body would be quite handsome despite the great handicap of the 26-inch height of the frame from the ground.

In this connection I believe not enough attention is paid to the proportioning of the various spaces on the sides of a touring body. If the following points were observed one would see fewer unsuccessful designs.

1. Two adjoining spaces should not be equal.

2. Front and rear doors should have the same width, if possible. The rear door should not be cut out at the back.

3. The space between the doors should be perceptibly greater or less than the width of the doors.

4. The height of the doors should be perceptibly greater (or less, in a two-door body) than the width.

5. The height of the body sides should be perceptibly greater than either the height of the frame above the ground or the distance between the top rail of the body and the lower edge of the top when extended.

One would almost believe that the limousine landaulet shown in Fig. 9 is a foreign product were it not for the coachmaker's nameplate. The rear light is admirably large. Except for such details as the rather obtrusive hinges there is very little to criticise. The same may be said of the clean cut berline in Fig. 10 by the same coachmaker. In this case, however, the hood is not sufficiently tapered, with the result that there is a rather sudden swelling at the dash.

The bodies we have been examining were made by firms conversant with contemporary foreign design. The bodies of American cars, however, are made, as a rule, by the manufacturers of the chassis or else turned out by the hundred by

wholesale body builders. The result is that American cars have very little individuality, all that is allowed the purchaser being a choice of certain colors.

If we accept this excessive standardization as a necessary evil we should at least insist that the bodies forced on the purchasers should not be lacking in beauty, comfort and convenience. Yet too often is not this the case?

Take for example the windows in closed cars. It will almost invariably be found that they open little more than half way. If this occurred only in the rear light it could be understood as the mudguards interfere unless the body is kept within the frame. It is really unpardonable, however, that the door lights should not open completely.

Handwheels instead of the old sash and peg are now much used for operating the windows. The French practice of fusing a small handle upon the glass, and of fitting springs at the bottom of the window well powerful enough to compensate for the weight of the glass, may also be cited. The slightest pressure is sufficient to move the glass up and down. Care must be taken not to place the handle near the top of the window as otherwise the glass may crack.

With the individual front seats separated by an aisle now coming into vogue it would be so simple to make them adjustable. Apparently all drivers of any one make of car are expected to be of precisely the same height. How often we have seen tall drivers with their knees jammed against the steering wheels of their cars. If the front seats had a fore and aft motion of only a few inches a tremendous increase in comfort would be made. The ideal arrangement would be, of course, to have all seats adjustable longitudinally, vertically, and as to inclination.

In Fig. 11 a rather novel sedan is shown. It has two entrances, the one on the right including the center window, which is narrower than the corresponding one of the left. This body has its good points, but mounted on a frame almost 28 inches high it is placed at a disadvantage. As this is a single compartment body why are the beautiful striped curtains confined to the rear windows? Why not be logical and drape them around all the windows?

The body in Fig. 12, a limousine with cab sides, has quite pleasing proportions, but is slung far too high above the ground. I well remember that at the last Paris salon the exhibitor of this make had cleverly arranged ramps approaching the car from the sides, so that would-be purchasers accustomed to low-hung European productions would not be overwhelmed. It seems a pity that with the steering wheel at the left the driver cannot get out on his own side. The rear fenders have had the same outline for eight years, so that it is perhaps too late to suggest changing them, but they would really be more efficient if carried lower down behind the wheels. The bonnet, although slightly tapered, does not make the slightest pretense of merging into the dash, which is of the full blown convex type.

Windshield stay rods are still retained on the touring cars of this make (see Fig. 13), but are mere shadows of their former selves. The spare tires prevent the top from folding down neatly. The upholstery of the front seat arm, part of which is fastened upon the top rail of the door, should be noticed.

The general proportions of the touring body represented in Fig. 14 are very good. It is here seen that in order to provide sufficient clearance for American roads the frame need not be swung ridiculously high. The mudguards are very successful. Almost the only room for improvement lies in the upholstery. As probably no one sits on the doortops why upholster them?

In Fig. 15 is shown a boat body with an aisle between the front seats, which would be very pleasing were it not for the windshield irons, which are brought down far too low. The removal of the radiator cap from its usual place strikes the eye at once.

The body in Fig. 16 represents a considerable advance over those on the 1914 models, but it is far from perfect. It suffers chiefly from a plethora of moldings, especially on the hood and mudguards. The angle between vertical and rounded portions of the bonnet is continued in the cowl, giving the latter rather an awkward form.

Fig. 17 shows an attempt to build a difficult body—a domed roofed landaulet. It is unfortunately a failure from the point of view of appearance. The sides of the body are too low in relation to the window height. The rear light, however, can be lowered almost out of sight, a very good point.

The sedan in Fig. 18 is one of the best looking cars of its type. The roof should have been slightly more domed, rounding off into the back and having a drip molding along the top of the windows, or if the flat type it should project slightly in front. Arranging the door to open the other way would enable more of the running board to be of use.

We now come to what is perhaps the most advanced American stock touring body (Fig. 19). Its general lines are good, the second cowl being very well worked out. It is unfortunate, however, that on a four-cylinder chassis of 132-inch wheelbase it was found necessary to cut a piece out of the rear door. Also why should the driver be compelled to climb over the front seat passenger to reach the ground? If the spare tires were moved a little more forward and the front door farther to the rear it could be turned from an imitation door into a real one. Here I shall let the reader into a secret. There is a brake lever blocking the driver's exit in any case! Good points about the body are the high sides, the tumble-in along the top rail and the lack of protruding upholstery. A neat touch not appreciated in the photograph is the inclining of the windshield rearward two inches.

Compare the above body with that shown in Fig. 20, and the improvement resulting from concealing the upholstery is evident. The front seat in the latter car seems in imminent danger of bursting. One would little imagine that this body and that shown in Fig. 7 are both mounted on similar chassis. Such, however, is the case. Compare the relative positions of the steering wheels in Figs. 19 and 20. In one case the driver sits in the body, in the other case he sits on it.

The subject of Fig. 21 is one of the most powerful cars on the market, and it looks its part. The frame has been dropped abaft the hood, giving it a low-hung appearance despite the very large wheels. There are few points for criticism. The sides of the body might with advantage be as high as the hood, thus reducing the gap between body and top and hiding the folding seats. The ventilators at the base of the windshield, while efficient, are not beautiful. As the hood is not tapered there is a sudden swelling at the dash as in Fig. 10. An aisle separates the front seats, a very popular feature for 1915. On a two-door body it is better than a sliding or folding front seat, but as it reduces luggage carrying space it is not always desirable where unnecessary, as in this case.

The mudguards are very fine pieces of work. Particular notice should be given to the front ones with the lamp shells and valances in one piece with the guards themselves. The practice of this firm in mounting the headlamps on the mudguards has not been followed; 1, because of the difficulty in making the fenders perfectly rigid; 2, on account of the difficulty of refocusing the lamps to suit the individual driver; 3, on the score of appearance. In this position, however, the lamps can light up the holes in the road and not merely cast dense shadows across them.

In concluding this article perhaps I may be permitted to refer to a sedan body which I designed exactly two years ago. As seen in Fig. 22 the wind resistance is reduced to a minimum not only by the small surface normal to the direction of travel, but also by the hemispherical shape of the stern, which reduces the vacuum

behind the car and so minimizes the dust. A segment of the back swings open, giving access to a circular compartment for the spare wheel. This arrangement is, I think, ideal as the wheel is completely protected from the elements and does not mar the clean appearance of the car now considered so desirable.

Motorcycling Under Fire

THE present great war in Europe has been called, with a good deal of truth, the Motor War. For the first time in the history of the world, gasoline has become a factor of the utmost importance in the weal or woe of nations. Never since the invention of gunpowder has war suffered such an upheaval, has the science of war been subjected to such tremendous changes, as in the year of grace 1914. Textbooks on military tactics more than ten years old are as obsolete to-day as if they had been written previous to the discovery of steam and the transportation of armies on trains and steamships.

In the great glamour which naturally has been thrown around the automobile as the last word in rapid transportation of armies, one is apt to forget the "Little Brother of the Motorcar," as the motorcycle has been so well named. Not even the aeroplane has done as much service in the present war as the omnipresent, pestiferous, and yet self-effacing two-wheeler, whether propelled by the sturdy legs of the soldiers or the crackling, rattling explosions of the gasoline motor. There are probably more than 50,000 bicycles in active service at the "front" or immediately in back of it, and yet the newspaper-reading public hardly knows there is a single wheel in use. The splendid work of the automobile has overshadowed the less showy but just as important work of the bicycle, while the great usefulness of the motorcycle is but now beginning to be appreciated.

Limited by the manner of its construction and the demands for high speed, the motorcycle, of course, has not been heralded as an attacking or raiding medium as the automobile, or as a carrier of provisions and ammunition like the motor truck and omnibus, or as a savior of the wounded during the battle, as some small tricars and runabouts, but in its special field as dispatch bearer and guide, as well as an occasional reconnoitering patrol, it has surpassed the expectations of its users and supporters.

Letters from the battlefields rarely mention the motorcycle, but occasionally one gets a glimpse of its work in reports sent by the riders themselves to their favorite trade paper or perhaps to one or the other of the great British dailies. In a report covering the action in the Compiègne forest in the early stages of the war in France a British motocyclist tells of the troubles he had. "A most useful duty has been found," he writes, "for a number of our motorcyclists in watching and following any man suspected of being one of the numerous spies which the Germans maintain behind our lines. These generally work in British and French uniforms and they almost invariably get about on motorcycles, as not only can they thus cover more ground, but they are much less likely to run against inconvenient questioners. One, dressed as a British officer, was brought into the station at Compiègne while I was there. He had been collared by one of our own wheelmen in a rather curious way.

"For two or three days this motorcycling spy had been persistently shadowed by the Britisher, who at last, finding his quarry compelled to dismount, accosted him with a query as to his duties. The man, who spoke perfect English, laughed pleasantly and said he was on staff work. Our cyclist asked if he had any papers to show, adding that he himself was on police work. The stranger was quite willing to oblige and produced from his pocket some papers. 'That will show you who I am,' he remarked casually, displaying a couple of private letters directed to a Captain ——— of the ——— Regiment.

"'That's done you,' retorted the Britisher, covering the man with his revolver.

'It just happens that the man whose letter you've got is a particular friend of mine.' "*

Another British rider who was with the expeditionary forces of Great Britain says the life is none too easy. "The motorcyclist has to shift for himself; he moves too fast, too sudden, and too often to have any regular headquarters, so far as his eating and sleeping are concerned. After he has delivered a dispatch and is dismissed for the time being, he sets out to find somewhere to wash, something to eat, some place to sleep, and last, but not least, gasoline." He has no speed limits to worry over, but the disastrous consequences of running at high speed into the rear of a dark motor truck serve to keep his eyes straining and his ears alert, feet on the brake pedals, ready for instant action.

One of the greatest troubles of the motorcycle rider in war-ridden France and Belgium is the necessity of riding without a lamp at night. The explosions of the motor are loud enough to cover the call "Halt" of a sentry, and it is related that several motorcyclists were shot to death and a great many fired at by their own sentries because of their inability to hear the "Halt" signal. On one occasion a rider just managed to stop his machine in time to get the point of a French bayonet to within a couple of inches of his chest. Less powerful brakes and he would have been dead.

Plans are under way at present, based on the experiences of the first four months of the war, to substitute a system of light signals at night for sentries. Flashlight lamps have been tried out, as well as the old style red light, from which a covering cloth is drawn at the proper moment.

Dispatch riders tell with gusto of their growing ability in dodging flying shells coming toward them. The large shells, in particular, can be clearly "seen" at night and quite a few of the riders succeeded in evading death by swerving around the descending shells. On one occasion a big shell struck about fifty yards ahead of two motorcyclists coming at top speed and the hole torn into the roadway was so big that the machines could not avoid it. Both went headlong into the crater and were severely injured.

Still more interesting and dangerous is the lot of the motorcycle dispatch riders who are taking part in the East African fighting. One of them, in a letter to his folk in England, tells the following interesting story: "The other night, when it was just getting dark, the captain had to send me to the next camp, twenty-three miles away, and there is only one track, running right through jungle all the way. Off I went on the most exciting ride I have ever undertaken. I was fully armed with a service rifle and revolver, hunting knife, water bottle, haversack, and ammunition. The first thing I ran into was a pack of baboons, some of them nearly five feet high. They were terribly excited and ran in front of the machine in the full light for about a mile. The brutes simply wouldn't shift. You ought to have heard them bark. I would not have gotten into their clutches for all the money in the world. However, they at last turned into the bush.

"I also saw two fine leopards. One brute did not attempt to move until I was within three yards of him. I suppose he finally thought it wiser to get out of the path of the glaring light and the roar of the engine. He jumped snarling to one side and—maybe I didn't go when I got passed him! He might have taken it into his head to follow me!"

While leopards and baboons do not bother the motorcyclist in the European field of war, he has his hands full with problems which somehow or other never seem to have been thought out before. For instance, it has been found that where a cavalry patrol of small size is chased by motorcyclists, all the former need do is drag a telegraph pole or tree across the road—there are hundreds of fallen trees everywhere along the roads! The horses can jump over, if trees are on the road: the motorcycles are detained long enough to allow the horsemen to escape. In one case three motorcyclists of the British force were surprised by a number of Uhlans and driven into flight. A tree lying across the road stopped the machines just behind a curve, and they were forced to dismount and fight from behind the tree. Several Uhlans were killed and wounded and two of the cyclists also were shot, when the third one thought of a loud police whistle he carried. His shrill blast took the Uhlans by surprise, they evidently believing it a call for assistance from some nearby force. They wheeled their horses and disappeared.

Motorcycles have been used in the field operations for the following work:

1. Carrying orders to the motor truck columns and to cavalry commanders.
2. Guiding motor trucks to their destination.
3. Calling ambulances and reinforcements, guiding them to the places where they are needed.
4. Assisting in dragging machine guns and gun sections.
5. Police work on the roads behind the battle line.
6. Reconnoitering, which was formerly accomplished exclusively by cavalry.
7. Acting as scouts in advance of long convoys of automobiles, seeing that the roads are safe for traffic and free of obstacles.

* Extract from a letter which appeared in the British trade paper, *The Autocycle*, in the last week of October.

The Good Roads Movement

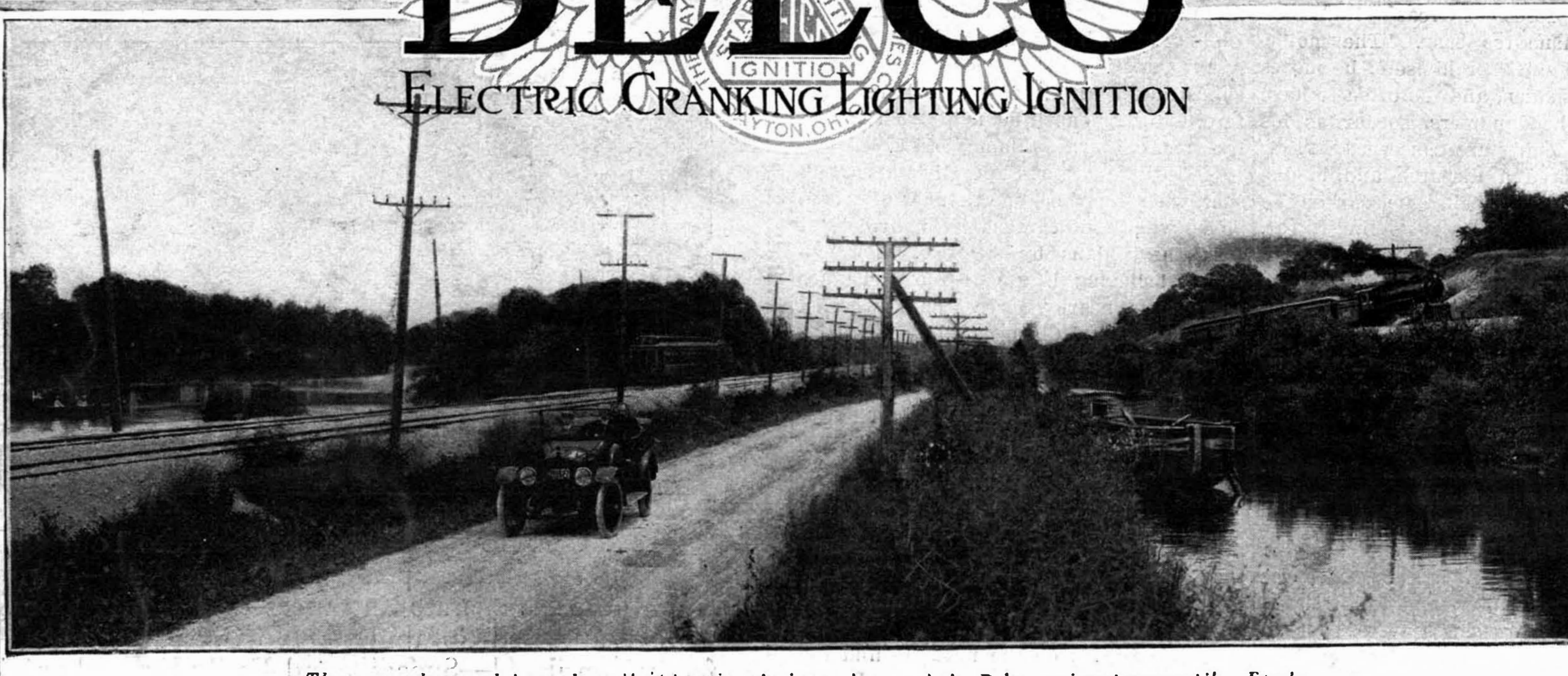
THAT remarkable progress has been made in the building of good roads throughout the United States during the past few years is proven by data recently obtained by the American Highway Association and soon to be published in the official Good Roads Year Book for 1915. It has been found that more than 34,000 miles of surfaced roads have been constructed during 1913 and 1914, and that during the ten-year period from 1904 to 1914 more than 96,000 miles have been completed. That this progress has been really amazing may be understood from the fact that in 1904 there were only 153,000 miles of surfaced roads of all types in the United States. That the movement is attaining momentum as it goes is proven by the fact that while the average mileage constructed per annum during the past ten years is 9,600 miles, the total completed for 1914 exceeded 18,000 miles. The report will show that something like 30,000 miles of highway have been completed with the aid of State funds, of which over $200,000,000 have been expended. The State aid movement began in 1892 and has therefore continued for twenty-two years. Only recently has it gotten well under way, as the results accomplished for 1913 and 1914 comprise a total of 10,000 miles of State aid highways completed, or in two years' time one third of the entire mileage constructed with the aid of State funds has been completed.

Only six States now, out of a total of forty-eight, are without State highway departments, and thirty States have granted actual money aid to the building of roads. The Year Book, which is the official reference publication for all good roads information, is a large cloth bound volume issued early in each calendar year by the American Highway Association.

Aggregation and Anticipation.—In the recent case of Read Machinery Company v. Jaburg et al., Circuit Judge Hunt, in the decision, takes occasion to say with regard to aggregation and anticipation, as follows: "Aggregation, as I understand it, will not apply where there is a combination of elements capable of co-acting to produce a unitary result, provided such co-action produces novel and improved results which are useful," and that "Upon the contention that there has been anticipation it is necessary, as I understand it, that the defendant shall show that all of the elements of the plaintiff's patent or the mechanical equivalents are found in the same description or machine where they do substantially the same work by substantially the same means."

DELCO

ELECTRIC CRANKING LIGHTING IGNITION



The canoe, the canal boat, the railroad train, the interurban and the Delco equipped automobile—Epoch making steps in the development of transportation—all caught at the same instant by the eye of the camera

THROUGHOUT the history of the world civilization has hung closely upon the heels of transportation—

First there was the narrow trail through the woods and along the mountain side—the trunk of a tree across the stream—

Mankind walked and beast of burden carried—

Travel was slow and very circumscribed—

The world lived in a myriad of little communities, each separated from the other by the barrier of distance—

Then came boats—slow, cumbersome affairs—propelled by oar or sail or by mules along the canal routes—The world was brought a little closer together—a very little—

One day a boiling tea kettle suggested to an alert boy the latent power of steam—

The steam engine came—

A new era in transportation and in civilization dawned—

Railroads and steamships multiplied—they connected cities and nations—they developed agriculture and mining and industrial resources—they brought the world close together into one great intimately connected community—

Then came the electric car—the interurban—supplementing and still further developing the civilizing influence of railroad and steamship lines—

And finally came the automobile—crude at first, but quickly developing into a vehicle of almost unlimited speed and power—of universal adaptation and of marvelous grace and beauty.

The most popular of all means of transportation, the automobile has become the center of an enormous industry—it has revolutionized manufacturing and commercial methods—It has wonderfully developed agriculture by bringing the farm and the city close together—it has renewed the interest in road making—one of the original influences for better civilization—it has largely increased the world's wealth and the world's pleasure—

And yet in spite of all this remarkable development the automobile was, until a very few years ago, sadly hampered by crude methods of starting and lighting—

Then came the Delco system—starting, lighting, ignition—electricity adding the one final touch to the efficiency of the gas driven car—

In a few short months the automobile industry was revolutionized—

The motor car that hitherto had required skill and a strong right arm to operate became as safe and simple and easy to control as an electric carriage—

The scope of its usefulness was greatly broadened—

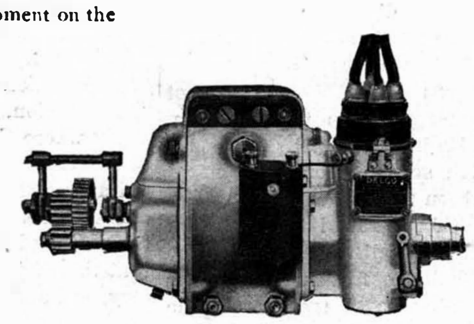
The safety and pleasure of driving were intensified—

Today 190,000 Delco Equipped cars are in operation—

Thousands of them are being driven easily and safely by women—

You will find the Delco System at the Automobile Shows as regular equipment on the

Cadillac	Hudson	Cole	Cartercar
Buick	Oldsmobile	Moon	Jackson
Oakland	Stevens-Duryea	Auburn	Westcott
	Patterson		



These three units comprise the entire Delco System—cranking, lighting and ignition